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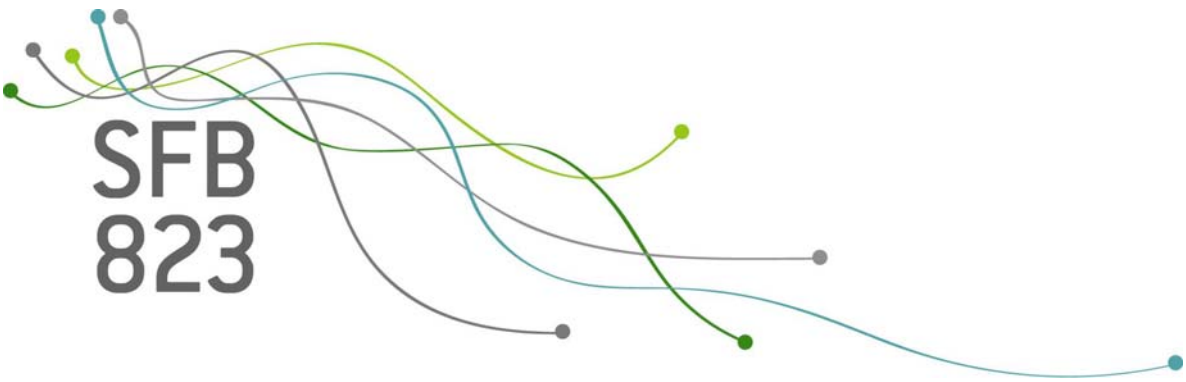

Behavioral Economics and Energy Conservation – A Systematic Review of Non-price Interventions and their Causal Effects

Mark Andor and Katja Fels

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Abstract

Research from economics and psychology suggests that behavioral interventions can be a powerful climate policy instrument. This paper provides a systematic review of the existing empirical evidence on non-price interventions targeting energy conservation behavior of private households. Specifically, we analyze the four nudge-like interventions referred to as social comparison, pre-commitment, goal setting and labeling in 38 international studies comprising 91 treatments. This paper differs from previous systematic reviews by solely focusing on studies that permit the identification of causal effects. We find that all four interventions have the potential to significantly reduce energy consumption of private households, yet effect sizes vary immensely. We conclude by emphasizing the importance of impact evaluations before rolling out behavioral policy interventions at scale.

JEL Codes: D10, D12, L94, L95, Q41, Q48, Q58

Keywords: Systematic review; Behavioral economics; Energy demand; Energy efficiency; Environmental certification; Social norms

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1. Introduction

Climate change mitigation programs are on the political agenda worldwide. As a result of ambitious CO2-reduction goals, policymakers are increasingly interested in non-price interventions targeting private household energy consumption. Both economic and psychological research has shown that behavioral interventions – also referred to as nudges – can be powerful tools in shaping people's behavior in a variety of domains (see, among others, the influential publication by Thaler and Sunstein 2008).[1] Non-price measures are relatively inexpensive to implement and do not interfere with people's choice sets as strongly as, for example, taxes or bans on certain products. Consequently, policy makers are now exploring nudges as a cost-effective approach for reducing energy consumption (Allcott 2015). If proven effective, these interventions could be established as an integral and complementary component of climate change policy (Allcott and Mullainathan 2010). This is why researchers are increasingly interested in understanding the effect of non-price measures on residential energy consumption.

This paper presents findings of a systematic review of the effectiveness of behavioral interventions to induce energy conservation. We study the following four interventions: social norms, commitment devices, goal setting, and labeling. Furthermore, the review focuses on "higher quality" studies. To this end, we only include those studies that employ an empirical estimation strategy enabling the identification of a *causal* relationship between a policy intervention and consumption behavior. To our knowledge, it is the first study that systematically reviews all published results from behavioral economics and related areas of research that are based on a rigorous evaluation of causal effects.

[1] The fact that the book Nudge (Thaler and Sunstein 2008) has already been cited more than 7,000 times can be seen as one indicator of a growing academic interest in behavioral interventions (cf. Allcott and Kessler 2015).

Our study builds on a few earlier reviews that only focus on a subset of our interventions. Many of these point to potential problems of including effects from correlational studies in their sample, i.e. studies that are not able to disentangle causation from correlation. Abrahamse et al. (2005) evaluate the effectiveness of some interventions aiming to encourage households to reduce energy consumption. They conclude that information has an influence on knowledge, but does not necessarily result in behavioral changes or energy savings. Rewards have effects on energy conservation, but they are rather short-lived. Feedback, in particular when it is given frequently, can also be effective. More recently, Karlin et al. (2015) conducted a meta-analysis on the effect of feedback on energy usage. They conclude that feedback is effective but with significant variation in effects. Furthermore, Delmas et al. (2013) analyze the effect of information strategies on energy savings and find a substantial reduction effect on average. However, in a similar vein as Abrahamse et al. (2005), they conclude that the effect diminishes with the rigor of the study, indicating potential methodological issues in the considered literature. In particular, none of the existing reviews takes into account whether the considered studies apply a method that has the potential to identify the causal effect of the intervention, which is critical to the question of its policy relevance (Imbens and Wooldridge 2009).

Consequently, our systematic review differs from previous research by solely focusing on studies that have the potential to identify causal effects between the intervention and the outcome. Furthermore, we include articles published up to December 2015 in working paper series as well as peer-reviewed journals to provide the most comprehensive and up-to-date account of research in economics and psychology. This is particularly important because there has been a growing number of high-quality studies in the recent past. Hence, our review comprises several very recent large-scale randomized controlled field experiments. As an additional contribution, our systematic

review is the first to account for labeling as a non-price intervention, which has been applied worldwide on a large scale and potentially affects millions of household decisions each year.

The paper proceeds as follows. In the subsequent section, we define and motivate the four considered interventions. Section 3 explains the methodology of the systematic review. In Section 4, we synthesize and discuss the results. Section 5 concludes with recommendations for researchers and policy makers.

2. Behavioral interventions and energy conservation

A considerable percentage of annual emissions in industrial countries is induced by residential energy consumption. In addition, private households are a prime target for behavioral interventions (Karlin et al. 2015). Households may conserve energy in two ways: First, they can change their consumption of energy services, for example by reducing lighting use. Second, they can modify their purchasing behavior and invest in energy efficiency, for example by buying a highly efficient washing machine.[2] Behavioral interventions with the aim of inducing energy conservation can therefore target either the purchase decision or more directly the consumption behavior. Below we examine the four non-price interventions considered in our systematic review and their potential effects on energy-conservation behavior of private households.

[2] The purchase of an energy efficient appliance will ultimately result in reduced energy consumption when expected energy savings are not completely offset by an increase in the use of the appliance, which is known as the rebound effect (see, for instance, Frondel and Vance 2013).

Social comparison

Social comparison refers to the process of giving households information about their energy consumption in relation to the consumption of comparable households. Such a comparison is closely connected to also receiving feedback about one's own behavior. The chosen reference group should be relevant for the treated household (Abrahamse et al. 2005) and can be, for instance, consumers of the same energy provider or households within the same postcode-level. Moreover, the choice of the reference level is important: the household's consumption can either be compared to the average consumption level of the reference group or to a more ambitious group, e.g. the most efficient 10 percent.

The potential effect of a social comparison might be triggered by three phenomena. First, many people exhibit reference dependent preferences (Kahneman 2003). Accordingly, one reference point is social norms. Complying with these norms increases most individuals' utility whereas deviating from it typically leads to disutility caused by social disapproval (Schubert and Stadelmann 2015). Second, in situations of uncertainty, individuals may use other peoples' behavior as orientation by implicitly assuming that those others have more information about the socially desired behavior (Allcott and Mullainathan 2010, see also Delmas et al. 2013). Consequently, people tend to adjust their actions according to the prevalent group behavior. Third, social comparisons evoke feelings of competition (Abrahamse et al. 2005). This is especially important when the household's consumption level lies above the average or above some threshold that the household perceives as desirable (for example, belonging to the most efficient 10 percent of costumers).

Commitment Devices

Commitment devices are "a set of interventions that allow individuals to lock themselves today into the action that they want to take tomorrow" (Allcott and Mullainathan 2010: 2). Examples of commitment devices are oral or written pledges or promises to conserve energy (Abrahamse et al. 2005). The commitment can either be a promise to oneself, or alternatively it can be made public.

The idea behind voluntarily binding one's own future behavior is that some people are aware that they sometimes have time-inconsistent preferences (O'Donoghue and Rabin 1999). For instance, as O'Donoghue and Rabin (2008) point out, many people procrastinate sometimes to the extent that the desired action is never taken.

A commitment device helps individuals to overcome such time-inconsistent preferences by providing a source of motivation: it compares the present situation with a desired future state (van Hoewelingen and van Raaij 1989). When the commitment is a pledge to oneself, it appeals to a personal norm (the individual wants to satisfy expectations towards itself). A public commitment creates expectations by others, thereby leading to social pressure (Abrahamse et al. 2005).

Goal Setting

Goal setting combines commitment with a concrete reference point. Instead of pledging to conserve energy, a household specifically promises, for instance, "to reduce energy consumption by 10 percent within the next month". Not only setting a reduction level but also a deadline for achieving this goal facilitates an evaluation of success or failure. This increases pressure but also motivation by making satisfaction conditional on a desired level of performance (van Houwelingen and van Raaij 1989). A goal can be chosen by

the household itself (being a form of commitment device) or externally set (for example by institutions).

The underlying mechanisms explaining the potential effects of goal setting are similar to those of commitment devices: time-inconsistent preferences and a lack of self-control. In addition to that, a specific goal targets reference-dependent preferences (Abrahamse et al. 2005): individuals aim at a pre-determined level and judge their performance according to this reference point. Achievement of the goal provides a feeling of accomplishment, whereas failure creates disutility even if the goal level was externally set (Bandura 1986).

Labeling

A label is a tag that summarizes information on a good in an easily accessible way. This can be achieved by presenting a selection of information about the product's attributes on the label or by visualizing the most relevant information in a graphical manner. In the domain of energy consumption, labels can, for example, comprise information on energy usage levels of appliances or energy efficiency standards of houses.

In principle, there are two different sorts of labels. Either the labeling program is voluntary and an appliance is awarded the label for satisfying certain criteria like the US Energy Star Label, or a label is mandatory for all appliances, as with the EU Energy Label. In the latter case, goods can be ranked according to their performance along the criteria specified by the label, for instance the EU energy efficiency classes.

Consumers potentially respond to labels by ascribing more attention to certain features of the good. As a label makes selected criteria (more) salient, it aims at the availability heuristic, i.e. a simplifying rule that gives highly accessible features a stronger influence on decisions while information of low

accessibility will largely be ignored (Kahneman 2003). This remains true even when costs of gathering relevant information, for example on average usage levels or life expectancy of appliances, is low (Schubert and Stadelmann 2015).

3. Methodology

Following the guidelines for systematic reviews suggested by the Campbell Collaboration (2014), we take five successive steps to identify and analyze relevant studies: setting up criteria for including studies in the review, literature search, selection of studies, data extraction, and data analysis.

3.1 Inclusion criteria (PICOS)

As a first step, we developed a set of criteria along the so-called PICOS – an acronym for participants, interventions, comparisons, outcomes, and study designs (Campbell Collaboration 2014). The PICOS guided the selection of studies in the further process. We include studies targeting private households or individuals living in an industrialized or emerging country where the living situation (especially in regard to energy consumption) is comparable to an industrialized country. Studies focusing on energy consumption in official buildings or enterprise settings are excluded.

Our focus is on the four interventions social comparison, commitment devices, goal setting, and labeling. We also consider combinations of these interventions with each other or with additional non-price measures (e.g. feedback, energy savings tips). In contrast, all studies combining these interventions with financial incentives (for instance, dynamic pricing) are excluded from the review, as long as they do not allow to identify the effect of the non-price intervention separately.

Regarding the outcome, we include all studies that report an individual's or household's actual or self-assessed usage level of energy, gas,

or water. For labeling, we also consider secondary outcomes like the perception of and the willingness to pay for energy efficiency. These secondary outcomes influence usage levels via different channels (as discussed in Section 2).

We include all studies that permit the identification of the causal relationship between the intervention and the outcome of interest. Hence, studies are considered if their methodology is based on a higher quality causal inference design like randomized controlled trials (RCT), matching, difference-in-differences, instrumental variable estimation, and regression discontinuity design, or if they control for self-selection with alternative methodologies.[3] Studies that do not employ methods suitable for identifying the causal effect of an intervention are excluded from the review. Overall, we apply no time restriction: all study results published in a journal or as working paper up until the end of 2015 are considered in the review.

3.2 Literature search

We used two main avenues to identify relevant studies: First, a keyword search in databases, and second, a backward search on relevant review studies. Before the database search, we pre-determined a systematic combination of keywords for each of the four interventions (see Appendix B1). These keywords were employed on two databases: EconLit, consisting of more than 785,000 articles from peer-refereed journals and acknowledged working paper series in economics, and ScienceDirect, accessing more than 13 million articles from journals in different disciplines, from which our study chose the disciplines "Economics, Econometrics, Finance", "Psychology", "Social Sciences", "Environment", and "Energy". This returned a total of 988 results.

[3] For an excellent overview of high quality causal inference designs see Angrist and Pischke (2009) or Imbens and Wooldrigde (2009).

Additionally, we conducted backward searches in the literature of the following four review studies: Abrahamse et al. (2005), Delmas et al. (2013), Karlin et al. (2015) and Lokhorst et al. (2013). Of the 147 articles identified, we included 71 studies after ruling out duplicates. This garnered a total of 1,059 studies for the screening process of this review (see Figure 1).

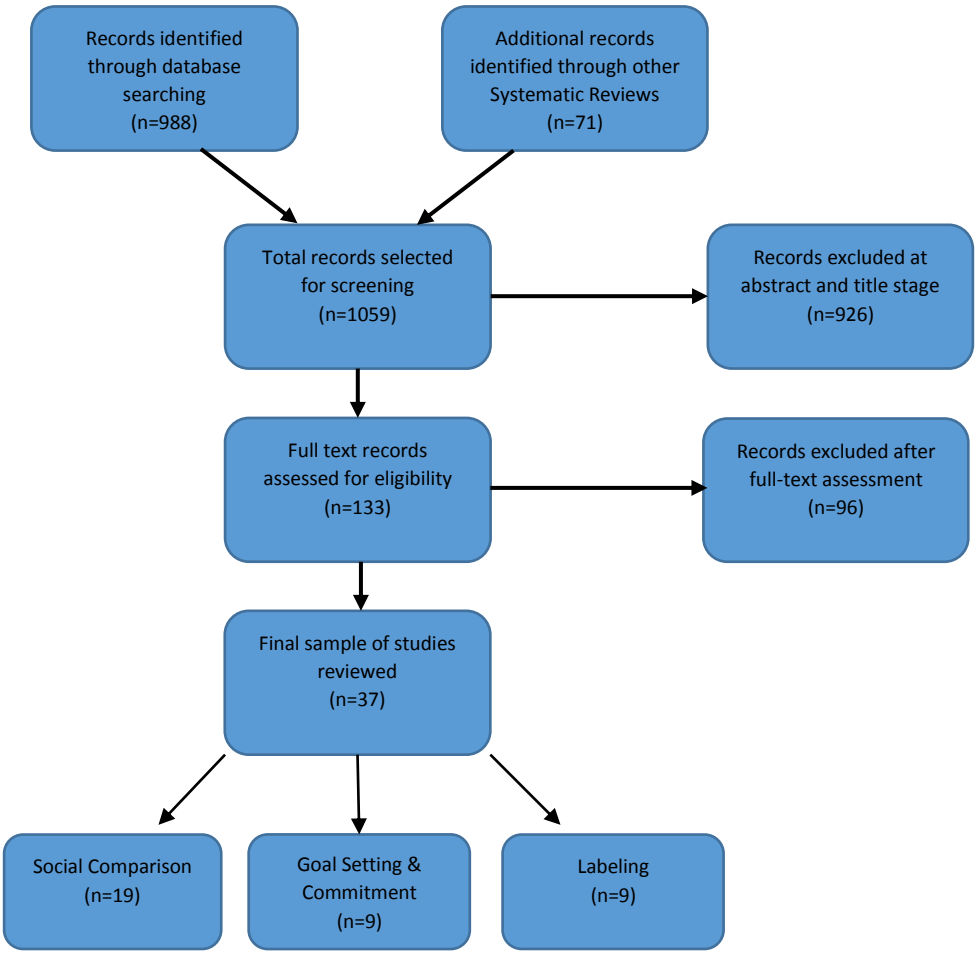


Figure 1: Overview of results in the searching, screening and selection process[4]

[4] The study by Kurz et al. (2005) investigates a social comparison treatment as well as labeling. Here it is categorized as a social comparison study.

3.3 Selection of studies

All studies were screened by independently reading the title and abstract and assessing whether a study satisfied all inclusion criteria set up in the PICOS via an inclusion decision form (see Appendix B2). We excluded 926 studies due to this procedure, leaving 133 articles for full text screening (see Figure 1), which again was conducted independently. In cases of differing assessments, we consulted a third (independent) scientist and solved discrepancies by discussion. A common reason for exclusion was that studies discussed strategies for energy conservation behavior theoretically or approached it with a qualitative design without actually measuring the effect of an intervention. When screening the selected full text articles, the main reason for exclusion was that studies neither applied a higher quality causal inference design nor controlled for self-selection. In contrast, at the start of the screening process a majority of papers was completely off-topic. Finally, 37 articles satisfied the criteria of this systematic review.

3.4 Data extraction

We developed a detailed coding sheet (see Appendix B3) based on the guidelines of the Campbell Collaboration (2014). Two reviewers coded each study independently of each other according to the same criteria. In cases in which the extracted information was ambiguous (for instance regarding the method of causal inference design), we consulted a third (independent) scientist and discrepancies were solved by discussion. The results from the data extraction are summarized in a results table (see Appendix A1).

4. Results

4.1 Brief characterization of included studies

Research interest

Among the considered interventions, social comparison has attracted the most research attention. While 20 independent studies tested at least one social comparison treatment, only nine evaluate the effects of goal setting and commitment. In the following analysis, we evaluate the latter two interventions together since most relevant studies are overlapping. Additionally, nine studies assess the impact of labeling. In terms of available treatment effects, the analysis of our systematic review can rely on 37 documented effects for social comparison, 26 for goal setting and commitment, and 26 for labeling. The difference in numbers between articles and treatment effects is due to the fact that many studies consider more than one relevant intervention or evaluate multiple versions of the intervention in question.

Regarding the studies' publication dates an interesting pattern emerges. While the peak of research interest in goal setting and commitment was in the 1980s, followed by a longer neglect and a recent rediscovery,[5] labeling has been largely neglected up till 2011. Since then, we observe a growing academic interest in analyzing the impact of the intervention. Similarly, research interest in the causal effects of social comparison on energy consumption behavior is fairly recent: the overwhelming majority of studies was published after the year 2004, with 70% of studies in this sub-sample (14 articles) being more recent than 2010.

Methods

For social comparison and goal setting/commitment, one dominant method is applied, namely the evaluation via randomized controlled trials (RCT). This methodology not only produces a high internal validity but also has advantages in terms of external validity as it (in most studies) observes real-life behavior. In contrast, most of the

[5] Two thirds of studies were published between 1978 and 1989, the remaining third since the year 2002.

studies on labeling are conducted as laboratory experiments or choice-experiments within online-surveys, which have low external validity. Specifically, researchers ask subjects, for instance, which appliance they would choose in a set of choices and attribute differences in choice patterns to the way the choice set is presented (which differs between control and treatment group). Obviously, such choices are not real purchases but rather decisions within a hypothetical and limited choice set. It is thus not certain whether the reported effects would also occur in a real world setting, and results should be treated with caution despite their high internal validity. However, a few studies also exploit a policy change as a natural experiment or conduct an RCT with a labeling intervention.

Geographical location

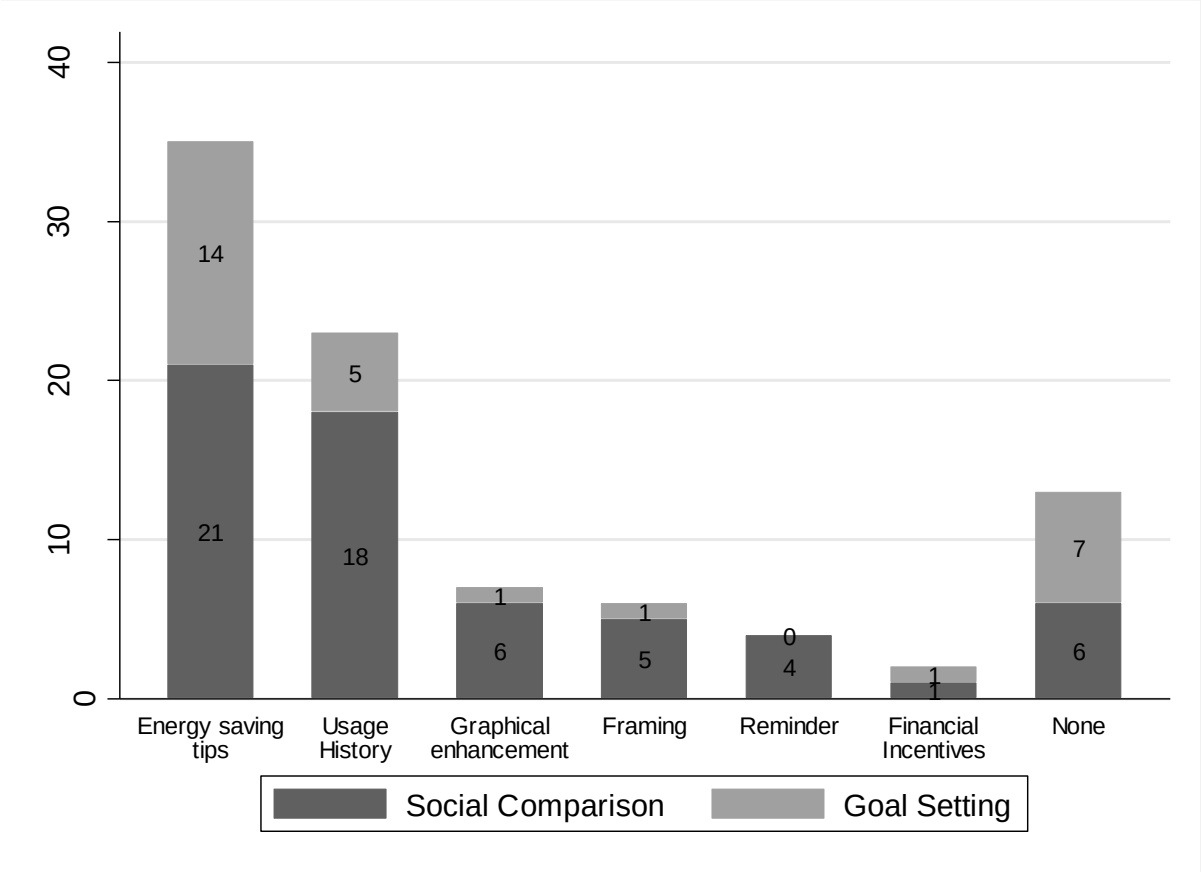
Most of the studies identified by the systematic review are located in the US. This is especially true for goal setting/commitment, which up to date only has been evaluated in the US and the Netherlands. For social comparison and labeling, studies are conducted in several countries, for instance Japan, Australia, Finland and Great Britain. The majority of published research on the two interventions, however, also targets a study population in the US.

Combination of interventions

For social comparison and goal setting/commitment, almost all studies combine the considered interventions with other treatments. This poses an immense challenge for identifying the actual effect of the intervention. It moreover makes it difficult to compare effects from different studies, as they do not evaluate the same treatment. Figure 2 shows that energy savings tips and a comparison of usage history are most popular among treatment combinations (see Figure 2). Within the sub-sample of studies that allow identification of the pure effect by not combining the intervention with additional treatments, other limitations apply. For instance, the relevant social comparison studies suffer from methodological shortcomings (e.g. no reported effect sizes). For goal setting and commitment devices, there are substantial differences

regarding the intensity of the treatment, because the required level of the goal varies as well as the criterion whether the level was self-selected or externally set. All in all this prohibits arriving at a coherent picture regarding the existing empirical evidence on the pure effects of the considered interventions.

Figure 2: Additional interventions combined with social comparison and with goal setting/commitment treatment

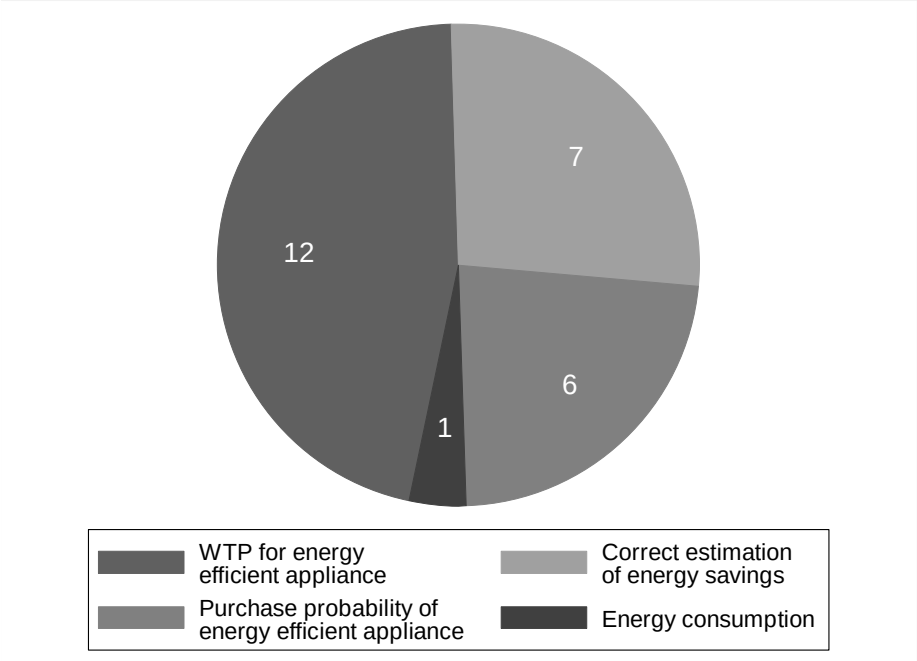


Outcomes

The vast majority of studies on social comparison and goal setting/commitment focus on actual or self-assessed energy consumption as their outcome of interest. For labeling, the case is different. Most studies evaluate the effect of labels on the willingness to pay for energy efficient appliances, followed by studies on an estimation of the energy savings potential or hypothetical purchase decisions regarding energy efficient appliances (see Figure 3). Only one labeling-study looks at actual energy consumption. Consequently, the quality of empirical evidence differs between the

interventions: While the majority of labeling studies are based on stated preferences approaches (with their well-known limitation of hypothetical nature compared to revealed preferences), for the other interventions most studies analyze real behavior.

Figure 3: Analyzed outcomes in studies with a labeling treatment



4.2 Synthesis of the evidence

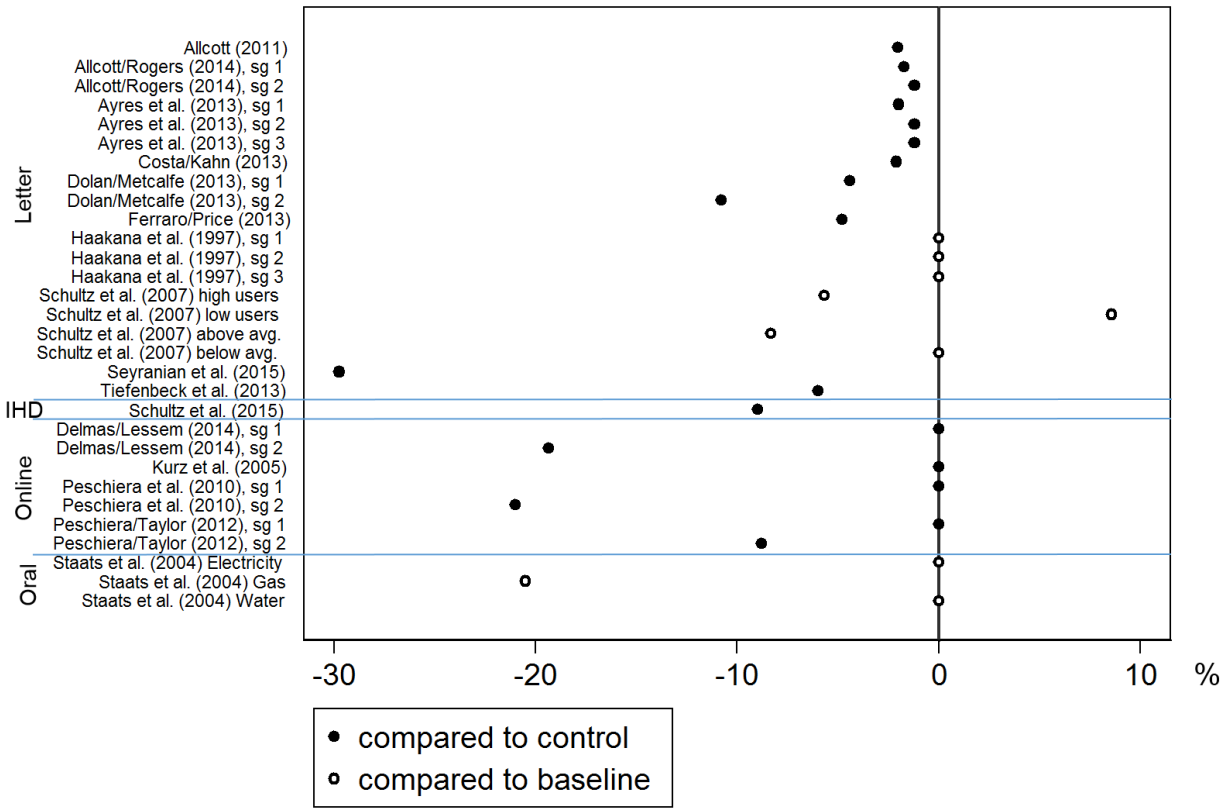
4.2.1 Social Comparison

Overall, the empirical evidence suggests that social comparison is an effective treatment. All but two of the 20 studies present statistically significant results in at least one of their analyzed treatment groups.[6] A social comparison intervention results in a reduced energy consumption of private households ranging from 1.2% to 30% compared to the control group (see Figure 4). The only study showing an increase in energy usage level is Schultz et al. (2007) in one of their treatment groups. Yet, the respective treatment group was deliberately restricted to low users only, demonstrating the so called boomerang effect, i.e. that a social comparison can lead to

[6] The study of Hakaana et al. (1997) is not considered in this regard, as the article does not report any significance levels at all.

adverse effects for the group that performs well in the comparison. They additionally show that the boomerang effect can be eliminated by adding an injunctive message. With regard to other outcomes, Komatsu and Nishio (2015) find a significant (positive) effect of the social comparison treatment on the motivation to conserve energy.

Figure 4: Estimated Effects of Social comparison by medium



Note: Studies are sorted by treatment-medium and in alphabetical order. Effects of studies that do not report significance levels are depicted as nil-effects. "sg" and "avg" stand for "study group" and "average", respectively. Comment: The studies of Komatsu and Nishio (2015) and Kantola et al. (1984) are not included in the graph as they do not mention the magnitude of the measured significant conservation effects.

The heterogeneity of effects may be attributed to the medium via which the household receives the social comparison. As a tendency, we observe that online and In-Home-Display (IHD) treatments seem to result in a higher effect than letters. However, IHD-social comparisons are still underresearched. Another noteworthy fact

is that studies with higher sample sizes (above 80,000) find smaller effects (around 2%). Both observations are compatible with existing evidence from previous reviews (Karlin et al. 2015).

One specific intervention design, the social comparison based "home energy reports" (HER) by the private company "*Opower"*, has attracted major research attention. Opower cooperates with numerous US-energy suppliers and mails the HER to more than ten million households in the United States with the aim of reducing electricity consumption. The HER is a two-page letter with a bar graph comparing the household's energy consumption to its geographically nearest neighbors in similar house sizes on the first page and energy saving tips on the second page. Several high quality studies in this review (Allcott 2011; Ayres et al. 2013; Costa and Kahn 2013; Allcott and Rogers 2014) report significant, yet modest reduction effects. The empirical evidence for this specific intervention is outstanding as the internal and external validity for the US is high, long-term effects are documented and cost-benefit analyses are conducted.[7] The numerous high quality studies can be seen as best practice for the evaluation of an intervention at large scale.

In all studies, in which a comparison of two similar combinations of interventions is possible, the effect increases when social comparison is added to the treatment (Ferraro and Price 2013; Mizobuchi and Takeuchi 2013). Moreover, Schultz et al. (2015) find a significant reduction in energy consumption of 9% compared to an insignificant treatment effect, when social comparison is added to the initial treatment intervention.

[7] On the basis of 111 RCTs that evaluate the HER, Allcott (2015) shows that even for the exceptional case that there exists many replications, program evaluations can still give systematically biased out-of-sample predictions due to a "site selection bias". In this example, predictions from the first 10 replications substantially overstate efficacy because, among others, utilities in more environmentalist areas are more likely to adopt the program, their customers are more responsive to the treatment, and utilities initially target their treatment at higher-usage consumer subpopulations. In a very recent study, Andor et al. (2017) show that social comparison based home energy reports are most likely not a cost effective climate policy instrument in many countries, in particular in Europe, due to lower electricity consumption levels and carbon intensities. For a study population in Germany, they additionally measure a substantially smaller treatment effect of social comparison based home energy reports.

The only two studies that aim to identify the pure effect of social comparison have methodological limitations. Haakana et al. (1997) find that a pure social comparison treatment shows similar or smaller effects as a social comparison with energy savings tips. The study, however, provides no information about significance levels for any of the effects. Komatsu and Nishio (2015) analyze the self-assessment on one's own consumption in regard to the neighbors' consumption and the own motivation to conserve energy. They find ambiguous effects of the social comparison treatment, but do not report effect sizes. Moreover, the analysis is not based on actual behavior but solely relies on self-assessments.

Some studies suggest that social comparison might also trigger adverse effects. Schultz et al. (2007) show that low users significantly increased their energy consumption after having learned that they are below-average users. This raises important questions regarding a tailored application of social comparison treatments. Furthermore, Tiefenbeck et al. (2013) investigate side-effects of a social comparison treatment. They find a significant reduction in water consumption of 6% after they provided weekly feedback about water consumption levels per capita, accompanied by a social comparison with the most efficient 10% of users, and tips about how to conserve water. At the same time, the electricity consumption of the treatment group increased by 5.6%. This result might be seen as first evidence of the so called moral self-licensing effect, the phenomenon that past good deeds favor a positive self-perception that in turn creates licensing effects, leading people to engage in behavior that is less likely to be in line with their moral values (Nisan and Horenczyk 1990). If such side-effects occur, it is not clear whether an intervention induces sustainable behavior in a broader sense, even if the estimated treatment effect suggests a reduction of the 'direct' outcome (in this example: water consumption).

In regard to long-term-effects, no clear picture emerges. Several studies document a reinforcement of effects in the long-run for some of their treatment groups (Delmas and Lessem 2014; Allcott and Rogers 2014; Dolan and Metcalfe 2013; Schultz

et al. 2007). In Staats et al. (2004), two initially insignificant short-term effects increase and become significantly different from the control group when measured two years after the intervention stopped. In other studies, treatment effects decrease (Ferraro et al. 2011; Schultz et al. 2015; Staats et al. 2004; Schultz et al. 2007), remain or become insignificant (Delmas and Lessem 2014; Dolan and Metcalfe 2013; Tiefenbeck et al. 2013; Schultz et al. 2007). It would be desirable to identify the driving factors for these heterogeneous effects. Yet, based on the existing empirical evidence, we do not observe any obvious indications.[8] As long-term-effects are crucial for the cost-effectiveness of the interventions, their analysis should be one focus of future research.

In sum, social comparison presents an effective treatment. Yet, researchers and policy makers should closely monitor potential adverse effects on certain subgroups of households (below-average users) and on consumption patterns regarding other goods (moral licensing effect). Furthermore, the analysis of long-term-effects and cost-benefit-analysis should be an inherent part of the impact evaluation.

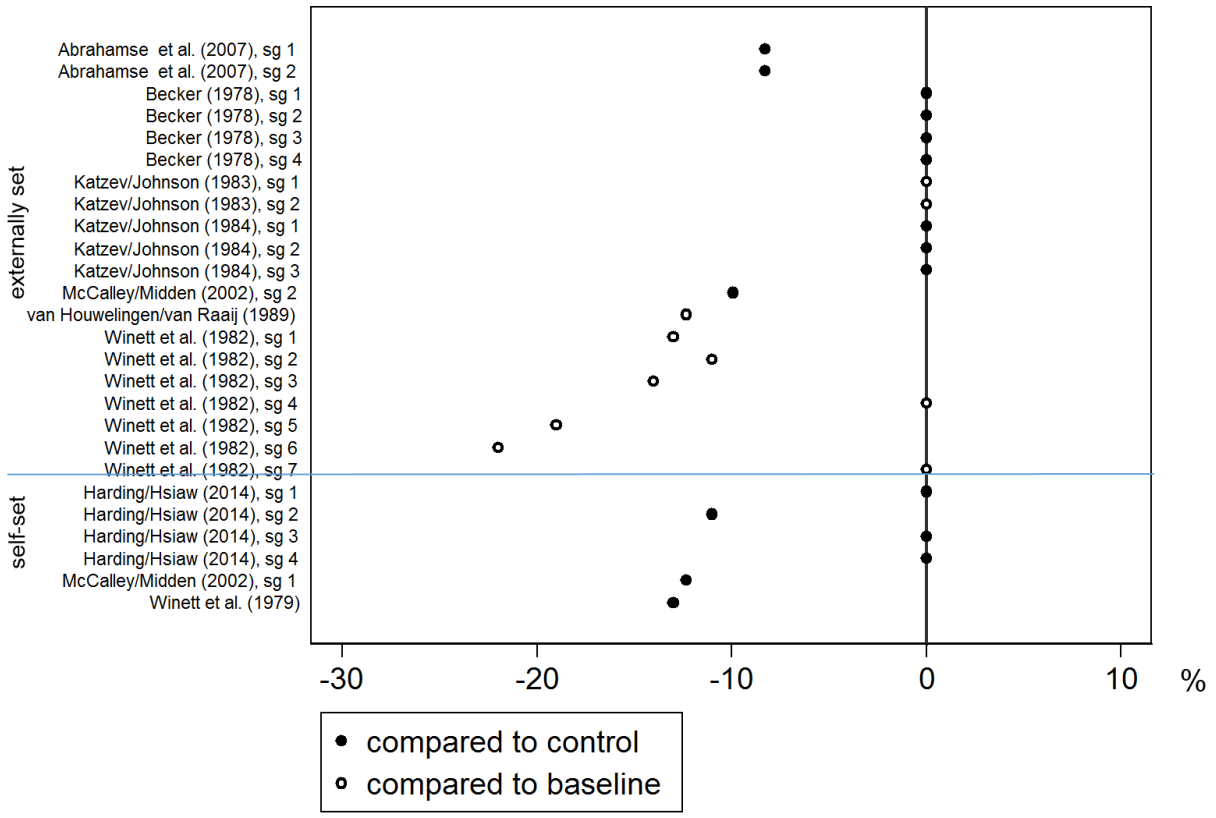
4.2.2 Goal Setting and Commitment Devices

Many of the identified studies on goal setting and commitment suffer from methodological shortcomings, despite satisfying the criterion of applying a methodology suitable to identify a causal effect. For instance, they test several treatments in their RCT despite relying on very small study samples, or they do not report significance levels of results. Thus, the picture regarding an assessment of treatment effects is not quite clear: more than half of the documented effects are not significantly different from zero or cannot be depicted as such because no significance level is reported (see Figure 5). The reason for this may either be that the treatment

[8] In a recent study, Brandon et al. (2017) explore the underlying mechanisms of long-run reductions in energy consumption induced by a social comparison (specifically the HER by Opower, see above). Using the data of 38 natural field experiments, they find that the physical capital channel (e.g. insulating the house or buying a more energy efficient washing machine) is more important for the persistence of effects than habit formation within the household.

actually has no effect, or that the study's features (in particular a not sufficiently powered sample) contribute to the result.

Figure 5: Goal setting/commitment-effects by self-set or externally set goal



Note: Studies are sorted by self-set and externally set goals/commitments and in alphabetical order. Effects of studies that do not report significance levels are depicted as nil-effects. "sg" stands for "study group".

Interpreting the results of the identified studies, self-set goals seem to result in a significant reduction effect when they are chosen realistically (Harding and Hsiaw 2014; McCalley and Midden 2002; Winett et al. 1979). Harding and Hsiaw (2014) report from a field study with more than 12,000 households that the sub-sample selecting the achievable goal of energy conservation between 0% and 15% reduced their consumption by 11%. The authors still measure a significant reduction effect after 18 months. At the same time, the treatment group that selected a more optimistic goal (15%-50%) also saved energy shortly after the start of the program. However, their effort vanished after they received feedback about their usage development,

presumably because they realized that it would be impossible to achieve the ambitious goal. In contrast, both sub-samples choosing either a zero-goal or a more-than-50% goal showed no behavior change at all. However, we have to note that the results could be caused by self-selection: people who are in general more motivated to conserve energy could have selected themselves into more realistic goals, while people who are generally unwilling to change their behavior chose zero or unrealistically ambitious goal levels.

Goals that are externally set by the experimenters have resulted in either insignificant effects or energy savings up to 22% compared to baseline consumption (Figure 4). Many of the reported significant effects stem from Winett et al. (1982), who conducted two RCT studies, but with a relatively small sample size of in total 83 households for five treatment groups. After having taken part in a meeting, researchers asked participants to sign a commitment to reduce their energy consumption by 15% within the next 35 days. In addition to frequent feedback about their progress, households received an audio tape with tips on how to save energy. One study was conducted during winter, the other one during summer. All but one of six treatment groups showed significant and relatively high reduction effects ranging from 11% to 22%.

In another study, an externally set goal of 10% resulted in a significant energy conservation effect of about 12.3% (van Houwelingen and van Raaj 1989). The effect remained significant one year after the intervention. Abrahamse et al. (2007) measure a smaller, but still significant effect of a 5%-goal in their RCT. In addition to these findings, a laboratory study by McCalley and Midden (2002) points to energy saving potential of externally set goals of around 20%.

On the other hand, Becker (1978) as well as Katzev and Johnson (1984) were not able to confirm significant effects of external goal setting in the field. Yet, in another study, Katzev and Johnson (1983) find that insignificant effects in the short-run become significant in the long-run.

In sum, goal setting and commitment still need substantial research efforts. The significant results point to a relatively high energy conservation potential of around 10%, while at the same time we cannot rule out that many of the insignificant results are due to underpowered samples. It seems to be a promising avenue for further research to evaluate the effect of energy conservation goals with a well-powered study set up, especially goals that are externally set.

4.2.3 Labeling

All but two of the identified studies on labeling report significant results in at least a subsample of their study population. Regarding effect sizes, they also point to potentially pronounced effects of labeling.

Five studies evaluate the effect of labels under real-world conditions. Brounen and Kok (2011) document significantly higher sales prices for houses with a "green" energy efficiency EU-label (classes A, B, C) than for comparable houses without such a label. Houde (2014) exploits two natural experiments concerning the Energy Star Label. He observes a significantly higher willingness to pay for refrigerators when they have the label. His analysis is based on a comparison of the same models of refrigerators before and after the criteria of the Energy Star Label were tightened. In the second study, the measured positive effect of the Energy Star Label on the willingness to pay for refrigerators is not significant. In a similar vein, Allcott and Taubinsky (2015) cannot find a significant effect of a label on the probability to purchase an energy-saving lightbulb in their RCT in a big electrical store in the US. In the study by Kurz et al. (2005), which provided the treatment group with labels on the consumption levels of the household's own appliances, effects range from zero to a reduced energy consumption of 23%.

The choice experiment of Heinzle (2012) shows that the willingness to pay for a more efficient TV significantly increases when consumers are given information on absolute operating costs over the course of ten years. However, it significantly decreases when the label provides information on annual operating costs. Study

participants in a further hypothetical choice experiment of Newell and Siikamäki (2014) show a significantly lower willingness to pay compared to the potential savings they could gain by operating a more efficient warm water processors when they only received information on consumption costs and CO2-emissions. Yet, once this information was accompanied by an Energy Star Label, the willingness to pay increased above the cost effective level.

Waechter et al. (2015), moreover, show that energy efficiency classes strongly influence the consumer's estimation of the energy consumption level of appliances, to the extent that people will make decisions based on the energy efficiency class even when concrete and readily apparent consumption information contradicts it. In addition, Ölander and Thøgersen (2014) provide evidence for the positive effect of visualizing information in form of a simple label: changing an energy efficiency scale from a complex "A+++ - D"-system to a simpler "A – G" more than doubled the probability that an energy-efficient device would be chosen.

In sum, even though up to now there is not a vast amount of research on labeling, we identify a remarkable potential of the intervention. Not only do hypothetical purchase decisions in choice experiments confirm their effectiveness, but so too do evaluations of labels in the field. Future research should focus on different elements of labels, like the framing of costs or the mode of ranking, and test their separate and combined effects in the field.

5. Discussion and Conclusion

This paper conducted a systematic review of behavioral interventions to induce residential energy conservation. In contrast to the existing literature, this review focused on studies that permit the identification of the causal relationship between the intervention and the outcome of interest. In addition, it is the first review to cover labeling, an intervention that affects millions of people worldwide.

We find that all four interventions have the potential to significantly reduce energy consumption of private households. While the vast majority of studies documents a significant reduction effect for the social comparison intervention, results for the other interventions are mixed. Social comparison has been the most researched intervention, in terms of both quality and quantity. In particular, the several "*Opower* studies" that investigate the causal effect of social comparison based home energy reports on energy consumption deliver broad empirical evidence and can be seen as best practice for program evaluations of energy conservation interventions. Yet, even for this intervention, many open questions remain: What is the actual pure effect of social comparison? Under which circumstances do social comparisons cause adverse effects? How much does the effect of social comparison interact with the medium by which it is delivered? First evidence on these questions indicate that adverse effects seem to matter and that it can make a difference if the social comparison is delivered by a letter, electronically online or via IHD.

Pre-commitment and goal setting have not yet been researched extensively, and existing studies show major methodological shortcomings mainly in terms of underpowered samples. Yet, studies that document significant effects show conservation potential of around 10%. It is thus a promising avenue for further research to evaluate these interventions with a sufficiently large study sample, preferably in the field.

Although energy labels are applied worldwide, labeling is a very recent field of research. First evidence shows that labels can be effective with regard to the perception of and the willingness to pay for energy efficiency. Early results by laboratory experiments are confirmed by some first field studies. Because the existing empirical evidence is mostly based on stated preference approaches, though, a promising field of future research is the evaluation of the effects of labels by analyzing revealed preferences.

The review moreover clearly shows that the amount of studies that satisfy the quality criterion of causal inference increased in the last few years. There are presumably three reasons for this development: the improving quality of empirical research, an increasing interest in behavioral economics, and the need to find effective interventions to trigger energy conservation. However, there is still a lot to be done. Although we focused on 'higher quality' studies that are potentially able to identify causal effects, only few studies within the sample contain evidence to back up concrete policy recommendations. Obstacles are, for instance, insufficiently powered sample sizes, poor reporting of statistical tests, and study populations that are different from the target population. Furthermore, the minority of studies discusses the benefits and costs of the intervention, a prerequisite to give policy recommendations.

To sum up, we are surprised how little we know. We therefore call for systematic evaluations of these and similar interventions potentially able to trigger energy conservation before a large-scale rollout. It seems surprising that an intervention such as labeling is applied worldwide but there is little knowledge about the actual impact.

Future studies should focus on at least three crucial points: First, assess the causal effect of the intervention with a suitable methodology and a sufficiently powered sample that enables identification of even small effects with statistical precision. Second, researchers should refrain from combining too many different treatments. We need evidence on the pure effect of the chosen interventions before we begin to potentially reinforce this effect by additional treatments. Third, long-term effects of the intervention should be analyzed and the intervention costs should be documented in order to enable a careful cost-benefit-analysis on the treatment's effectiveness. At best, interventions should be ex-ante evaluated before they are rolled out at large-scale, for instance by randomized field experiments within the target population.

Literature

Abrahamse, W., Steg, L., Vlek, C., and Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of environmental psychology* 25(3), 273-291.

Abrahamse, W., Steg, L., Vlek, C., and Rothengatter, T. (2007). The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents. *Journal of Environmental Psychology* 27 (4), 265–276. DOI: 10.1016/j.jenvp.2007.08.002.

Allcott, H., and Mullainathan, S. (2010). Behavior and energy policy. *American Association for the Advancement of Science* 327 (5970), 1204-1205. DOI: 10.1126/science.1180775.

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics* 95 (9-10), 1082–1095. DOI: 10.1016/j.jpubeco.2011.03.003.

Allcott, H. (2015) Site selection bias in program evaluation. *The Quarterly Journal of Economics* 130 (3), 1117-1165.

Allcott, H., and Rogers, T. (2014). The short-run and long-run effects of behavioral interventions: Experimental evidence from energy conservation. *American Economic Review* 104 (10), 3003–3037. DOI: 10.1257/aer.104.10.3003.

Allcott, H., and Kessler, J.B. (2015). *The welfare effects of nudges: A case study of energy use social comparisons* (NBER Working Paper No. 21671). National Bureau of Economic Research.

Allcott, H., and Taubinsky, D. (2015). Evaluating behaviorally motivated policy: Experimental evidence from the lightbulb market. *American Economic Review* 105 (8), 2501–2538. DOI: 10.1257/aer.20131564.

Andor, M., Gerster, A., Peters, J., and Christoph M. Schmidt (2017). Social norms and energy conservation beyond the US. Discussion Paper.

Angrist, J.D., and Pischke, J.-S. (2009). *Mostly harmless econometrics: An empiricists' companion*. Princeton university press.

Aste, N., Adhikari, R.S., and Manfren, M. (2013). Cost optimal analysis of heat pump technology adoption in residential reference buildings. *Renewable Energy* 60, 615–624. DOI: 10.1016/j.renene.2013.06.013.

Ayres, I., Raseman, S., and Shih, A. (2013). Evidence from two large field experiments that peer comparison feedback can reduce residential energy usage. *Journal of Law, Economics, and Organization* 29 (5), 992–1022. DOI: 10.1093/jleo/ews020.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*, Prentice Hall.

Bauwens, L., Fiebig, D.G., and Steel, M.F.J. (1994). Estimating end-use demand: A bayesian approach. *Journal of Business and Economic Statistics* 12 (2), 221–231.

Becker, L.J. (1978). Joint effect of feedback and goal setting on performance: A field study of residential energy conservation. *Journal of Applied Psychology* 63 (4), 428-433. DOI: 10.1037/0021-9010.63.4.428.

Bedwell, B., Leygue, C., Goulden, M., McAuley, D., Colley, J., and Ferguson, E. (2014). Apportioning energy consumption in the workplace: A review of issues in using metering data to motivate staff to save energy. *Technology Analysis and Strategic Management* 26 (10), 1196–1211.

Brandon, A., Ferraro, P.J., List, J.A., Metcalfe, R.D., Price, M.K., and F. Rundhammer (2017): Do The Effects of Social Nudges Persist? Theory and Evidence from 38 Natural Field Experiments. (NBER Working Paper No. 23277).

Brounen, D., and Kok, N. (2011). On the economics of energy labels in the housing market. *Journal of Environmental Economics and Management* 62 (2), 166–179. DOI: 10.1016/j.jeem.2010.11.006.

Brutscher, P.-B. (2011). Payment matters? An exploratory study into the pre-payment electricity metering.

Buchanan, K., Russo, R., and Anderson, B. (2014). Feeding back about eco-feedback: How do consumers use and respond to energy monitors? *Special Section: Carbon Reduction at Community Scale* 73, 138–146. DOI: 10.1016/j.enpol.2014.05.008.

Campbell Collaboration (2014). *Campbell Systematic Reviews: Policies and Guidelines*, Campbell Systematic Reviews 2014: Supplement 1.

Costa, D.L., Kahn, M.E. (2013). Energy conservation 'nudges' and environmentalist ideology: Evidence from a randomized residential electricity field experiment. *Journal of the European Economic Association* 11 (3), 680–702. DOI: 10.1111/jeea.12011.

Darby, S. (2006). Social learning and public policy: Lessons from an energy-conscious village. *Special Section: Carbon Reduction at Community Scale* 34 (17), 2929–2940. DOI: 10.1016/j.enpol.2005.04.013.

Delmas, M.A., Fischlein, M., and Asensio, O.I. (2013). Information strategies and energy conservation behavior: A meta-analysis of experimental studies from 1975 to 2012. *Energy Policy* 61, 729–739. DOI: 10.1016/j.enpol.2013.05.109.

Delmas, M.A., and Lessem, N. (2014). Saving power to conserve your reputation? The effectiveness of private versus public information. *Journal of Environmental Economics and Management* 67 (3), 353–370. DOI: 10.1016/j.jeem.2013.12.009.

Di Cosmo, V., Lyons, S., and Nolan, A. (2014). Estimating the impact of time-of-use pricing on irish electricity demand. *Energy Journal* 35 (2), 117–136.

Dogan, E., Bolderdijk, J.W., and Steg, L. (2014). Making small numbers count: environmental and financial feedback in promoting eco-driving behaviours. *Journal of Consumer Policy* 37 (3), 413–422.

Dolan, P., and Metcalfe, R. (2013). *Neighbors, knowledge, and nuggets: Two natural field experiments on the role of incentives on energy conservation* (Economics Working Paper No. 2589269). Becker Friedman Institute for Research. DOI: 10.2139/ssrn.2589269.

Dowd, A., Ashworth, P., Carr-Cornish, S., and Stenner, K. (2012). Energymark: Empowering individual Australians to reduce their energy consumption. *Special Section: Carbon Reduction at Community Scale* 51, 264–276. DOI: 10.1016/j.enpol.2012.07.054.

Ferraro, P.J., Miranda, J.J., and Price, M.K. (2011). The persistence of treatment effects with norm-based policy instruments: evidence from a randomized environmental policy experiment. *The American Economic Review* 101 (3), 318-322. DOI: 10.1257/aer.101.3.318.

Ferraro, P.J., and Price, M.K. (2013). Using nonpecuniary strategies to influence behavior: Evidence from a large-scale field experiment. *Review of Economics and Statistics* 95 (1), 64-73. DOI: 10.1162/REST_a_00344.

Frondel, M., and Vance, C. (2013). Energy efficiency: Don't belittle the rebound effect. *Nature* 494, 430-430. DOI: 10.1038/494430c

Haakana, M., Sillanpaeae, L., and Talsi, M. (1997). The effect of feedback and focused advice on household energy consumption. Paper presented at the Summer Study of the European Council for an Energy Efficient Economy.

Harding, M., and; Hsiaw, A. (2014). Goal setting and energy conservation. *Journal of Economic Behavior and Organization* 107, 209–227. DOI: 10.1016/j.jebo.2014.04.012.

Hargreaves, T., Nye, M., and Burgess, J. (2010). Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors. *Special Section: Carbon Reduction at Community Scale* 38 (10), 6111–6119. DOI: 10.1016/j.enpol.2010.05.068.

Hargreaves, T., Nye, M., and Burgess, J. (2013). Keeping energy visible? Exploring how householders interact with feedback from smart energy monitors in the longer term. *Special Section: Carbon Reduction at Community Scale* 52, 126–134. DOI: 10.1016/j.enpol.2012.03.027.

Heberlein, T.A., and Warriner, G.K. (1983). The influence of price and attitude on shifting residential electricity consumption from on- to off-peak periods. *Journal of Economic Psychology* 4 (1–2), 107–130. DOI: 10.1016/0167-4870(83)90048-X.

Heinzle, S.L. (2012). Disclosure of energy operating cost information: A silver bullet for overcoming the energy-efficiency gap? *Journal of Consumer Policy* 35 (1), 43–64. DOI: 10.1007/s10603-012-9189-6.

Houde, S. (2014). *How consumers respond to environmental certification and the value of energy information* (NBER Working Paper No. 20019). National Bureau of Economic Research. DOI: 10.3386/w20019.

Houde, S., and Aldy, J.E. (2014). Belt and suspenders and more: the incremental impact of energy efficiency subsidies in the presence of existing policy instruments (NBER Working Paper No. 20541). National Bureau of Economic Research.

Houwelingen, J.H. van, and van Raaij, W.F.(1989). The effect of goal-setting and daily electronic feedback on in-home energy use. *Journal of Consumer Research* 16 (1), 98–105. DOI: 10.1086/209197.

Imbens, G.W., and Wooldridge, J.M. (2009). Recent developments in the econometrics of program evaluation. *Journal of Economic Literature* 47 (1), 5-86. DOI: 10.1257/jel.47.1.5

Ivanov, C., Getachew, L., Fenrick, S.A.,and Vittetoe, B. (2013). Enabling technologies and energy savings: The case of EnergyWise Smart Meter Pilot of Connexus Energy. *Utilities Policy* 26, 76–84. DOI: 10.1016/j.jup.2012.10.001.

Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioural economics. *The American Economic Review* 93 (5), 1449-1475.

Kantola, S.J., Syme, G.J., and Campbell, N.A. (1984). Cognitive dissonance and energy conservation. *Journal of Applied Psychology* 69 (3), 416–421. DOI: 10.1037/0021-9010.69.3.416.

Karlin, B., Ford, R., and Zinger, J. (2015). The effects of feedback on energy conservation: A meta-analysis. *Psychological Bulletin* 141, 1205─1247.

Katzev, R.D., and Johnson, T.R. (1983). A social-psychological analysis of residential electricity consumption: The impact of minimal justification techniques. *Journal of Economic Psychology* 3 (3-4), 268-284. DOI: 10.1016/0167-4870(83)90006-5.

Katzev, R.D., and Johnson, T.R. (1984). Comparing the effects of monetary incentives and foot-in-the-door strategies in promoting residential electricity conservation. *Journal of Applied Social Psychology* 14 (1), 12-27. DOI: 10.1111/j.1559-1816.1984.tb02217.x.

Komatsu, H., and Nishio, K. (2015). An experimental study on motivational change for electricity conservation by normative messages. *Applied Energy* 158, 35–43. DOI: 10.1016/j.apenergy.2015.08.029.

Kurz, T., Donaghue, N., and Walker, I. (2005). Utilizing a social-ecological framework to promote water and energy conservation: A field experiment. *Journal of Applied Social Psychology* 35 (6), 1281-1300. DOI: 10.1111/j.1559-1816.2005.tb02171.x.

Lang, C., and Okwelum, E. (2015). The mitigating effect of strategic behavior on the net benefits of a direct load control program. *Energy Economics* 49, 141–148.

Litvine, D., and Wustenhagen, R. (2011). Helping 'light green' consumers walk the talk: Results of a behavioural intervention survey in the Swiss electricity market. *Ecological Economics* 70 (3), 462–474.

Lokhorst, A.M., Werner, C., Staats, H., van Dijk, E., and Gale, J.E. (2013). Commitment and behavior change: A meta-analysis and critical review of commitment-making strategies in environmental research. *Environment and Behavior* 45(1), 3─34.

Lutzenhiser, L. (1992). A cultural model of household energy consumption. *Energy* 17 (1), 47–60. DOI: 10.1016/0360-5442(92)90032-U.

McCalley, L.T., and Midden, C.J.H. (2002). Energy conservation through product-integrated feedback: The roles of goal-setting and social orientation. *Journal of Economic Psychology* 23 (5), 589–603. DOI: 10.1016/S0167-4870(02)00119-8.

Midden, C.J.H., and Ritsema, B.S.M. (1983). The meaning of normative processes for energy conservation. *Journal of Economic Psychology* 4 (1–2), 37–55. DOI: 10.1016/0167-4870(83)90044-2.

Mills, B., and Schleich, J. (2010). What's driving energy efficient appliance label awareness and purchase propensity? *At the Crossroads: Pathways of Renewable and Nuclear Energy Policy in North Africa* 38 (2), 814–825. DOI: 10.1016/j.enpol.2009.10.028.

Mizobuchi, K., and Takeuchi, K. (2013). The influences of financial and non-financial factors on energy-saving behaviour: A field experiment in japan. *Energy Policy* 63, 775–787. DOI: 10.1016/j.enpol.2013.08.064.

Murtagh, N. (2013). Individual energy use and feedback in an office setting: A field trial. *Energy Policy* 62, 717–728.

Newell, R.G., and Siikamäki, J.V. (2014). Nudging energy efficiency behavior: The role of information labels. *Journal of the Association of Environmental and Resource Economists*, 1(4), 555-598. DOI: 10.3386/w19224.

Nisan, M., and G. Horenczyk (1990). Moral balance: The effect of prior behaviour on decision in moral conflict. *British Journal of Social Psychology* 29(1), 29-42.

O'Donoghue, T., and Rabin, M. (1999). Doing it now or later. *The American Economic Review* 89 (1), 103-124.

O'Donoghue, T., and Rabin, M. (2008). Procrastination on long-term projects. *Journal of Economic Behavior & Organization* 66 (2), 161–175.

Oltra, C., Boso, A., Espluga, J., and Prades, A. (2013). A qualitative study of users' engagement with real-time feedback from in-house energy consumption displays. *Special Section: Carbon Reduction at Community Scale* 61, 788–792. DOI: 10.1016/j.enpol.2013.06.127.

Oseni, M.O., Pollitt, M. G., Reiner, D.M., Richter, L.L. Chyong, K., and Baddeley, M. (2013). 2013 EPRG public opinion survey: Smart energy survey – attitudes and behaviours.

Ölander, F., Thogerson, J. (2014). Informing versus nudging in environmental policy. *Journal of Consumer Policy* 37, 341-356. DOI: 10.1007/s10603-014-9256-2.

Paetz, A.-G., Dutschke, E., and Fichtner, W. (2012). Smart homes as a means to sustainable energy consumption: A study of consumer perceptions. *Journal of Consumer Policy* 35 (1), 23–41.

Peschiera, G., Taylor, J.E., and Siegel, J.A. (2010). Response–relapse patterns of building occupant electricity consumption following exposure to personal, contextualized and occupant peer network utilization data. *Energy and Buildings* 42 (8), 1329–1336. DOI: 10.1016/j.enbuild.2010.03.001.

Peschiera, G., and Taylor, J.E. (2012). The impact of peer network position on electricity consumption in building occupant networks utilizing energy feedback systems. *Energy and Buildings* 42 (8), 1329– 1336. DOI: 10.1016/j.enbuild.2012.03.011.

Pullinger, M., Lovell, H., and Webb, J. (2014). Influencing household energy practices: A critical review of UK smart metering standards and commercial feedback devices. *Technology Analysis and Strategic Management* 26 (10), 1144–1162.

Richalet, V., Neirac, F.P., Tellez, F., Marco, J., and Bloem, J.J. (2001). HELP (house energy labeling procedure): Methodology and present results. *Energy and Buildings* 33 (3), 229–233. DOI: 10.1016/S0378-7788(00)00086-4.

Schubert, R., and Stadelmann, M. (2015). Energy-using durables – why consumers refrain from economically optimal choices. *Frontiers in Energy Research* 3 (7), 1-13. 10.3389/fenrg.2015.00007.

Schultz, P.W., Nolan, J.M., Cialdini, R.B., Goldstein, N.J., and Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science* 18 (5), 429–434. DOI: 10.1111/j.1467-9280.2007.01917.x.

Schultz, P. W., Estrada, M., Schmitt, J., Sokoloski, R., and Silva-Send, N. (2015). Using in-home displays to provide smart meter feedback about household electricity consumption: A randomized control trial comparing kilowatts, cost, and social norms. *Energy* 90, Part 1, 351–358. DOI: 10.1016/j.energy.2015.06.130.

Seyranian, V., Sinatra, G.M., and Polikoff, M.S. (2015). Comparing communication strategies for reducing residential water consumption. *Journal of Environmental Psychology* 41, 81–90. DOI: 10.1016/j.jenvp.2014.11.009.

Shen, M., Cui, Q., and Fu, L. (2015). Personality traits and energy conservation. *Special Section: Carbon Reduction at Community Scale* 85, 322–334. DOI: 10.1016/j.enpol.2015.05.025.

Staats, H., Harland, P., and Wilke, H.A.M. (2004). Effecting durable change: A team approach to improve environmental behavior in the household. *Environment and Behavior* 36, 341-367. DOI: 10.1177/001391650326016.

Steg, L. (2008). Promoting household energy conservation. *At the Crossroads: Pathways of Renewable and Nuclear Energy Policy in North Africa* 36 (12), 4449–4453. DOI: 10.1016/j.enpol.2008.09.027.

Stillwater, T., and Kurani, K.S. (2013). Drivers discuss ecodriving feedback: Goal setting, framing, and anchoring motivate new behaviors. *Transportation Research Part F: Traffic Psychology and Behaviour* 19, 85–96. DOI: 10.1016/j.trf.2013.03.007.

Thaler, R.H., and Sunstein, C.R. (2008). *Nudge: Improving decisions about health, wealth, and happiness.* Yale University Press.

Tiefenbeck, V., Staake, T., Roth, K., and Sachs, O. (2013). For better or for worse? Empirical evidence of moral licensing in a behavioral energy conservation campaign. *Energy Policy* 57, 160–171. DOI: 10.1016/j.enpol.2013.01.021.

Verplanken, B., and Weenig, M.W.H. (1993). Graphical energy labels and consumers' decisions about home appliances: A process tracing approach. *Journal of Economic Psychology* 14 (4), 739–752. DOI: 10.1016/0167-4870(93)90019-H.

Waechter, S., Sütterlin, B., and Siegrist, M. (2015). The misleading effect of energy efficiency information on perceived energy friendliness of electric goods. *Carbon Emissions Reduction: Policies, Technologies, Monitoring, Assessment and Modeling* 93, 193–202. DOI: 10.1016/j.jclepro.2015.01.011.

Wang, Z., Zhang, B., Yin, J., Zhang, Y. (2011). Determinants and policy implications for household electricity-saving behaviour: Evidence from Beijing, China. *Special Section: Carbon Reduction at Community Scale* 39 (6), 3550–3557. DOI: 10.1016/j.enpol.2011.03.055.

Winett, R.A., Neale, R.A., and Grier, H.C. (1979). Effects of Self-Monitoring and Feedback on Residential Electricity Consumption. *Journal of Applied Behavior Analysis* 12 (2), 173-184. DOI: 10.1901/jaba.1979.12-173.

Winett, R.A., Hatcher, J.W., Fort, T.R., Leckliter, I.N., Love, S.Q., Riley, A.W., and Fishback, J.F. (1982). The effects of videotape modeling and daily feedback on residential electricity conservation home temperatur and humidity, perceived comfort and clothing worn: winter and summer. *Journal of Applied Behavior Analysis* 15 (3), 381-402. DOI: 10.1901/jaba.1982.15-381.

Yeomans, M., and; Herberich, D. (2014). An experimental test of the effect of negative social norms on energy-efficient investments. *Journal of Economic Behavior & Organization* 108, 187–197. DOI: 10.1016/j.jebo.2014.09.010.

Zhou, N, Fridley, D., McNeil, M., Zheng, N., Letschert, V., Ke, J., Saheb, Y. (2011). Analysis of potential energy saving and CO2 emission reduction of home appliances and commercial equipments in China. *At the Crossroads: Pathways of Renewable and Nuclear Energy Policy in North Africa* 39 (8), 4541–4550. DOI: 10.1016/j.enpol.2011.04.027.

Appendix A

Table A1: "Final Results Table"

Study[9]	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
Social Comparison							
Kantola et al. (1984)	**(1) Feedback, Social Comparison** [+ Framing, Energy saving tips] Households were informed once by letter that they showed an above-average electricity consumption despite having stated in an earlier survey that they feel an obligation to save electricity (the message pointed to the dissonance between answers in the survey and their actual consumption) + users were provided with pamphlets and cards on energy saving tips	(1) significantly lower electricity consumption / n.a.	118	Electricity	AU	RCT	**Long run effects:** n.a. **Costs:** n.a.
	(2) Feedback, Social Comparison [+ Energy saving tips] Households were informed once by letter that they showed an above-average electricity consumption + users were provided with pamphlets and cards on energy saving tips	(2) insignif. / n.a.					
	(3) Control Group [+ Energy saving tips] users were provided with pamphlets and cards on energy saving tips	(3) insignif. / n.a.					
	(4) Control Group Participants received a Thank-You letter for taking part in the experiment	(4) CG / n.a.					
Haakana et al. (1997)	**(1) Feedback, Social Comparison** [+ Energy saving tips] Participants received feedback and other information according to their wishes. Most households opted for comparisons of their own energy consumption with similar households in Finland in addition to personalized tips and an energy conservation video	a) (1) n.a. / (-7) (2) n.a. / (-5) (3) n.a. / (-5) (4) n.a. / (+1)	105	a) Electricity b) Water c) Gas	FI	RCT	No information about significance of effects **Long run effects:** n.a. **Costs:** n.a.
	(2) Feedback, Social Comparison [+ Energy saving tips]	b) (1) n.a./ (-4) (2) n.a. / 0 (3) n.a. / (+1)					

[9] *The identified articles have been categorized according to the interventions social comparison, commitment/goal setting, labeling, and are ordered based on their publication date within each category.*

*n = sample size; n.a. = not available; CG = control group; ***, **, * significance levels of 1%, 5% and 10%, respectively.*

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	As in treatment (1) but with tailored information in written form instead of a video **(3) Feedback, Social Comparison** As in treatment (1), but without any tailored information or energy saving tips **(4) Control Group** Participants of the Control Group didn´t know they were part of an experiment	(4) n.a. / (+1) c) (1) n.a. / (-9) (2) n.a. / (-7) (3) n.a. / (-4) (4) n.a. / (-3)					
Staats et al. (2004)	**(1) Feedback, Social Comparison** [+ Energy saving tips] Groups consisting of six to ten people met as „EcoTeams" once a month to discuss environmentally relevant behavior. During the sessions they received feedback about their energy savings. Topics at the meetings were: garbage, gas, electricity, water, transport and consumer behavior.	(1) n.a. / (-4.6) [insignif.] (2) n.a. / (-20.5)** (3) n.a. / (-2.8) [insignif.]	482	(1) Electricity (2) Gas (3) Water	NL	Diff-in-Diff	**Long run effects:** (2 years after stop of the EcoTeam-meetings) (1) (-7.6)** (2) (-16.9)** (3) (-6.7)** **Costs:** n.a.
Schultz et al. (2007)	**(1) Feedback, Social Comparison** [+ Comparison to usage history, Energy saving tips] Handwritten messages with information about how much electricity the households consumed in the previous week + descriptive normative information about the energy consumption of the average household in their neighborhood + preprinted suggestions for how to conserve energy; sample restricted to high users **(2) Feedback, Social Comparison** [+ Comparison to usage history, Energy saving tips] Same intervention as in (1) but sample restricted to low users **(3) Feedback, Social Comparison** [+ Comparison to usage history, Energy saving tips, Graphical enhancement] Same intervention as in (1) + sad face, because the households' consumption was above average **(4) Feedback, Social Comparison** [+ Comparison to usage history, Energy saving tips, Graphical Enhancement]	(1) n.a. / (-5.68)* (2) n.a./ (+8.57)* (3) n.a./ (-8.34)** (4) n.a./ (+2.32) [insignif.]	287	Electricity	US	RCT	**Long run effects:** (1) (-4.61) [insignif.] (2) (+9.66)** (3) (-5.97)* (4) (+1.0) [insignif.] **Costs:** n.a.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	Same intervention as in (2) + happy face, because the households consumed less than average						
Peschiera et al. (2010)	**(1) Feedback** [+ Comparison to usage history, Reminder] Online-feedback about individual past and present electricity consumption + three weekly reminders to check the online-tool **(2) Feedback, Social Comparison** [+ Comparison to usage history, Reminder] As in treatment (1) + comparison of the individual electricity consumption with the average consumption of the rest of the building **(3) Feedback, Social Comparison** [+ Comparison to usage history, Reminder] As in treatment (2) + information about the electricity consumption of "peers" (i.e. occupants of the building who in a pre-survey the treated households classified as "known") **(4) Control Group** Participants knew they were part of an experiment	(1) (-16) [insignif.] / (-30) [insignif.] (2) (-6) [insignif.] / (-22) [insignif.] (3) (-21)*** / (-34)*** (4) CG / n.a.	83	Electricity	US	RCT	**Long run effects:** n.a. **Costs:** n.a.
Allcott (2011)	**(1) Feedback, Social Comparison** [+ Comparison to usage history, Energy saving tips] Monthly / bimonthly/ quarterly feedback via mail (Home Energy Report with personal history of consumption, comparison to neighbors and tips to save energy) **(2) Control Group** No information about participation in study	(1) (-2,03)*** / n.a. (2) CG / n.a.	588 446	Electricity	US	RCT	Short-term effect measured one year after intervention. **Long run effects :** According to the author there is no evidence of a reduction of the effect with the treatment lasting for two years, but no specific numbers stated (although, see Allcott and Rogers (2014)) **Costs:** Costs of production and shipping of the reports divided by kWh of saved energy: 3,31 Cents/kWh
Ferraro et al. (2011) +	**(1) Control Group** [+ Energy saving tips] Onetime letter with tips to save energy	(1) (-0,66) (insign.) / (-8,41)	106 669	Water	US	RCT	**Long run effects** (measured two years after intervention) (1) +0,9 (insign.) / n.a.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
Ferraro and Price (2013)	**(2) Feedback** [+ Energy saving tips, Framing (social norm)] Onetime personalized letter with heavily norm-based language about saving water, feedback from the consumption bill, tips to save energy	(2) (-2,7)*** / (-10.08)					(2) (-0,22) (insign.) / n.a. (3) (-1,3)** / n.a. **Costs:** $ 0,575 per saved 1 000 gallons (= 3 785,41 Liter) of water
	(3) Feedback, Social Comparison [+ Energy saving tips, Framing (social norm)] Like (2) plus a comparison to the median water consumption of the preceding summer and a classification of the household into one of the consumption groups	(3) (-4,8)*** / (-12.01)					
	(4) Control Group No information about participation in experiment	(4) CG / (-7,83)					
Peschiera and Taylor (2012)	**(1) Feedback, Social Comparison** [+ Comparison to usage history] Participants get access to their electricity consumption data through an online-tool + information about consumption of the last seven days + a comparison with the average residential electricity use + weekly reminders to check the online-tool	(1) 0 [insignif.] / n.a.	88	Electricity	US	RCT	Effects are calculated for above-average users only. If below-average users are included in the sample, the effects turn insignificant. **Long run effects:** n.a. **Costs:** n.a.
	(2) Feedback, Social Comparison [+ Comparison to usage history] Same intervention as in (1) + data about the electricity use of "peers" i.e. occupants of the building the treated households mentioned to "know" in a pre-survey	(2) (-8.8)** / n.a.					
	(3) Control Group Participants knew they were part of an experiment	(3) CG / n.a.					
Ayres et al. (2013)	**(1) Feedback, Social Comparison** [+ Energy saving tips, Comparison to usage history, Graphical enhancement] Home Energy Reports (HER) about electricity consumption via mail, monthly for heavy users, quarterly for light users, with tips to save energy, personal history of consumption and comparison to neighbors (additionally laughing or sad smiley, depending on consumption being below- or above-average)	(1) (-2,02)*** / n.a.	84 000	(1) + (2): Electricity (3) Gas	US	RCT	**Long run effects:** n.a. **Costs:** (1) 4.94 Cents per kWh saved (2) 1.78 Cents per kWh saved (3) n.a.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	(2) Feedback, Social Comparison [+ Energy saving tips, Comparison to usage history, Graphical enhancement] Like (1), the HER additionally contained information about the gas consumption, frequency random (monthly/quarterly) **(3) Feedback, Social Comparison** [+ Energy saving tips, Comparison to usage history, Graphical enhancement] Like (2), gas consumption measured instead of electricity consumption **(4) Control Group** No information about participation in experiment	(2) (-1,22)*** / n.a. (3) (-1,20)*** / n.a. (4) CG / n.a.					
Costa and Kahn (2013)	**(1) Feedback, Social Comparison** [+ Energy saving tips, Comparison to usage history] Home Energy Reports (HER) about electricity consumption via mail, monthly for heavy users, quarterly for light users, with tips to save energy, personal history of consumption and comparison to neighbors **(2) Control Group** No information about participation in experiment	(1) Liberals: (-2,4)*** / n.a. Conservatives: (-1,7)*** / n.a. (2) CG / n.a.	81 772	Electricity	US	RCT	The study especially analyzes the intervention´s heterogeneous effects („Liberals“ vs. „Conservatives“). The average treatment effect is (-2.1)*** compared to the control group. **Long run effects:** n.a. **Costs:** According to the authors, the intervention might be cost-effective, but no specific statement.
Dolan and Metcalfe (2013)	**(1) Feedback, Social Comparison** Biannual feedback and comparison to neighbors´ consumption via mail **(2) Feedback, Social Comparison** [+ Energy saving tips] Like (1) + Tips to save energy **(3) Control Group** Feedback about personal electricity consumption	(1) (-4,4)*** / n.a. (2) (-10,8)*** / n.a. (3) CG / n.a.	569	Gas	GB	RCT	Experiment 2 of the article fits thematically and is generally suitable to identify causal effects, but the information in the working paper is contradictory and is therefore not listed here. **Long run effects:** (18 months after first Intervention) (1) (-7,0)* (2) (-6,0) (not sign.)

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
							Costs: According to the authors 333 kWh were saved for every Pound spent
Mizobuchi and Takeuchi (2013)	**(1) Feedback** [+ Financial Incentive, Comparison to usage history] Monthly feedback via mail, reward of 200 Yen (2$) for 1% reduction of energy consumption **(2) Feedback, Social Comparison** [+ Financial Incentive, Comparison to usage history] Monthly feedback via mail, comparison to other participating households, reward of 200 Yen (2$) for 1% reduction of energy consumption **(3) Control Group** Information about participation in study	(1) (-4,15)** / (- 5,876)** (2) (-6,48)** / (-8,196)** (3) CG / (-1,721)	208	Electricity	JP	RCT	Effects as difference from pre-treatment-consumption. The difference between the effects of (1) and (2) is statistically not significant. **Long run effects:** n.a. **Costs:** n.a.
Tiefenbeck et al. (2013)	**(1) Feedback, Social Comparison** [+ Energy saving tips, Framing (social norm)] Weekly feedback about the water consumption per capita and tips to save water, partly complemented by a social comparison with the 10% saving the most water or a social appeal to contribute one´s share to the mutual goal of energy conservation **(2) Control Group** Information that water consumption will be monitored in the course of a scientific study	(1) Water: (-6,0)** / n.a. Electricity: (+5,6)** / n.a. (2) CG / n.a.	154	Electricity and Water	US	RCT	Study shows adverse effect of (intended) savings in water consumption for consumption of electricity. Since tenants privately pay for gas and electricity, while water is billed collectively, income effects can be excluded. Water consumption was measured daily, electricity consumption weekly **Long run effects:** No more significant effects measured after two weeks: (1) Water: (-5,5) Electricity: (+0,3) (2) n.a. **Costs:** n.a.
	(1) Feedback, Social Comparison [+ Comparison to usage history, Energy saving tips]	(1) (-1,7)*** / n.a.	234 000	Electricity	US	RCT	**Long run effects:** 2009-2013 (following the

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
Allcott and Rogers (2014)	Monthly feedback via mail (Home Energy Report with personal history of consumption, comparison to neighbors and tips to save energy) **(2) Feedback, Social Comparison** [+ Comparison to usage history, Energy saving tips] Quarterly feedback via mail (Home Energy Report like in (1)) **(3) Control Group** No information about participation in study	(2) (-1,2)*** / n.a. (3) CG / n.a.					measurement of the effect after the shipping of four reports, the treatment groups were randomly re-allocated): - Stop of the intervention after two years: (-2)*** - Biannual receipt of Home Energy Reports : (-3,1)*** - Receipt of the Home Energy Reports in initial frequency: (-3,3)*** **Costs:** Costs of production and shipping of the reports divided by kWh of saved energy - Assuming that the savings-effect does not last: 3,2 – 4,44 Cents/kWh - Assuming that the effects last for the long term: 1,35 – 1,79 Cents/kWh
Delmas and Lessem (2014)	**(1) Feedback, Social Comparison** [+ Comparison to usage history, Reminder] Real-time feedback and comparison with other users through an online-platform, weekly reminder via e-mail **(2) Feedback, Social Comparison** [+ Comparison to usage history, Reminder] Additionally to (1) public rankings of which student rooms consume below- or above-average (via posters in the entrance hall and via e-mail) **(3) Control Group** No information about participation in experiment	(1) (-5,68) (insign.) / n.a. (2) (-19,36)** / n.a. (3) CG / n.a.	66	Electricity	US	RCT	**Long run effects:** 17 weeks after first intervention (1) (-6,5) (not sign.) / n.a. (2) (-24,76)* / n.a. (3) n.a. **Costs:** n.a.
Komatsu and Nishio (2015)	**(1) Feedback, Social Comparison** Onetime feedback via mail and comparison to median consumption	(1) No effect sizes given; tendencies for assessment of own	3 033	Electricity (indirect)	JP	RCT	In (1)-(3) the participants´ assessment of their own electricity consumption in comparison to the neighbors´ consumption was

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
		consumption: higher**					analyzed, in (4)-(6) it was the households´ motivation to save energy. **Long run effects:** n.a. **Costs:** n.a.
	(2) Feedback, Social Comparison Like (1) plus comparison to highest saving 25% of participants	(2) higher ***					
	(3) Feedback, Social Comparison [+ Framing (social norm)] Like (2) plus a message about the social acceptance / disapproval of own consumption	(3) higher ***					
	(4) Feedback, Social Comparison Like (1)	(4) Motivation to save energy: insign.					
	(5) Feedback, Social Comparison Like (2)	(5) insign.					
	(6) Feedback, Social Comparison [+ Framing (social norm)] Like (3)	(6) higher ***					
	(7) Control Group Simple feedback of electricity consumption	(7) n.a.					
Schultz et al. (2015)	**(1) Feedback** [+ Energy saving tips] Real-time feedback via IHD and provision of a „climate protection video“	(1) (-3,0) (insign.)) / n.a.	431	Electricity	US	RCT	**Long run effects:** (three months after Intervention) (1) (-0,81) (not sign.) (2) (+1,13) (not sign.) (3) (-7,02)** **Costs:** n.a.
	(2) Feedback [+ Energy saving tips] Real-time feedback via IHD with the consumption being converted to actual costs, video	(2) (insign.) / n.a.					
	(3) Feedback, Social Comparison [+ Energy saving tips] Real-time feedback via IHD and comparison to other participants, video	(3) (-9,0)** / n.a.					
	(4) Control Group Only video, no feedback	(4) CG / n.a.					
	(1) Control Group [+ Energy saving tips]	(1) CG / (+40,8) (insign.)	374	Water	US	RCT	Consumption was measured one week after the intervention.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
Seyranian et al. (2015)	Onetime letter with tips to save energy **(2) Feedback, Social Comparison** [+ Energy saving tips, Graphical enhancement] Like (1) plus information about own personal consumption in comparison to average consumption of neighborhood, complemented by a laughing or sad smiley **(3) Control Group** [+ Energy saving tips, Framing (social norm)] Like (1) plus a cover letter with the city logo, emphasizing the household´s role as a part of the community and stressing on water conservation as a mutual goal **(4) Control Group** [+ Energy saving tips, Framing (personal norm)] Like (1) plus a cover letter, setting water conservation as a goal, but accentuating the household as a single player and not as a part of the community	(2) (-29,74)* / (-0,1) (3) (-34,1)** / (+1,4) (insign.) (4) (-24,6) (insign.) / (+3,4) (insign.)					**Long run effects :** (four weeks after intervention) (1) CG / +16.2 (insign.) (2) (-11,5)** / +2,6 (insign.) (3) (-12,2)** / +2,6 (insign.) (4) (-12,1)*** / +3,5 (insign.) **Costs:** n.a.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
Commitment and Goal Setting							
Becker (1978)	**(1) Goal Setting** [+ Energy saving tips] Participants were asked to reduce their energy consumption by 20% compared to their baseline usage + they received energy conservation tips specific to their own household appliances	(1) (-1.3) [insignif.] / n.a.	100	Electricity	US	RCT	**Long run effects:** n.a. **Costs:** n.a.
	(2) Feedback, Goal Setting [+ Energy saving tips] Same intervention as in (1) + they received feedback about their energy consumption three times a week	(2) (-13) [insignif.] / n.a.					
	(3) Goal Setting [+ Energy saving tips] Participants were asked to reduce their energy consumption by 2% compared to their baseline usage + they received energy conservation tips specific to their own household appliances	(3) (+1.2) [insignif.] / n.a.					
	(4) Feedback, Goal Setting [+ Energy saving tips] Same intervention as in (3) + they received feedback about their energy consumption three times a week	(4) (-4.6) [insignif.] / n.a.					
	(5) Control Group Participants of the control group knew they were part of an experiment	(5) CG / n.a.					
Winett et al. (1979)	**(1) Feedback, Goal Setting** [+ Comparison to usage history, Graphical enhancement, Energy saving tips] Daily feedback sheet with information about electricity usage + comparison with own usage on the preceeding day + a happy or frowning smiley for a decrease or increase in consumption + usage change compared to baseline + feedback whether they achieved a goal, which they had set themselves in a meeting before the start of the experiment + energy conservation information	(1) (-13)*** / n.a.	71	Electricity	US	RCT	**Long run effects:** (1) (-11) (insign.) (2) (-7) (insign.) Effects are calculated relative to the mean consumption of the two control groups **Costs:** Feedback condition: - total expenditure per household = $26

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	(2) Feedback [+ Energy saving tips] Households had to read and report their daily electricity consumption + received energy saving information **(3) Control Group** Households agreed to participate in the study **(4) Control Group** Households denied to participate in the study	(2) (-7)* / n.a. (3) CG / n.a. (4) CG / n.a.					- Savings per household $44 from expected expenditures based on the comparison group's use during this same period and the marginal cost per KWH. self-monitoring: - total expenditure per household: $22 - Savings per household: $26
Winett et al. (1982)	**<u>Study 1 (during winter):</u>** **(1) Feedback, Goal Setting** [+ Energy saving tips] Participants took part in a meeting and received information about energy conservation + they had to sign a commitment to reduce their energy consumption by 15% within the next 35 days + they received written feedback about their energy use + they were provided with a tape which presented information on energy conservation in form of a discussion **(2) Goal Setting** [+Energy saving tips] Participants took part in a meeting and received information about energy conservation + they had to sign a commitment to reduce their energy consumption by 15% within the next 35 days + they received a video which presented model homes similar to the participants´ homes and explained possible ways to reduce energy consumption. **(3) Feedback, Goal Setting** [+ Energy saving tips] As in treatment (2) + feedback **(4) Goal-Setting** [+ Energy saving tips]	(1) n.a. / (-13)*** (2) n.a. / (-11)*** (3) n.a. / (-14)*** (4) n.a. / (-1) (insign.)	83	Electricity	US	RCT	**Long run effects:** n.a. **Costs:** n.a.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	As in treatment (1) but without feedback						
	(5) Control Group Participants of the control group knew they were part of an experiment	(5) CG / (+4)					
	Study 2 (during summer):						
	(6) Feedback, Goal Setting As in treatment (3) but without information on energy conservation	(6) n.a. / (-19)***					
	(7) Feedback, Goal Setting [+ Energy saving tips] As in treatment (1) but without discussion tape	(7) n.a. / (-22)***					
	(8) Goal Setting [+ Energy saving tips] As in treatment (2)	(8) n.a. / (-12) [insign.]					
	(9) Control Group Participants of the control group knew they were part of an experiment	(9) CG / (-2)					
Katzev and Johnson (1983)	**(1) Goal Setting** „Foot-in-the-door-treatment": Households were asked to fill in an energy conservation questionnaire. Afterwards, they were told to reduce their electricity consumption by 10% within the next two weeks	(1) n.a. / (+11) [insignif.]	66	Electricity	US	RCT	The subjects were recruited through a door-to-door solicitation procedure in which they were asked for permission to read their electricity meters as part of a study on residential energy consumption. **Long run effects:** (+1)** (-2)*** (-5)** (+5) (all effects compared to baseline period; significance compared to control group) **Costs:** n.a.
	(2) Goal Setting Households were asked to reduce their electricity consumption by 10% within the next two weeks	(2) n.a. / (+12) [insignif.]					
	(3) Control Group	(3) n.a. / (+7) [insignif.]					
	(4) Control Group Households agreed to have their electricity meters read by the experimenter	(4) CG / 0					

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
Katzev and Johnson (1984)	**(1) Goal Setting** [+ Energy saving tips] Households were asked to reduce their energy consumption by 15% within the next two weeks + received a utility guide for household energy conservation	(1) (-6.1) [insignif.] / (-13.4) [insignif.]	90	Electricity	US	RCT	**Long run effects:** (1) (-2.8) / (-14.3) (2) (-1.3) / (-12.8) (3) (+0.2) / (-11.3) (4) (-10.7) / (-22.2) (5) (-1.5) / (-13.0) (6) CG / (-11.5) All effects are insignif. **Costs:** n.a.
	(2) Goal Setting Households were asked to reduce their energy consumption by 15% within the next two weeks + had to fill in an energy conservation survey	(2) (+1.4) [insignif.] / (-5.9) [insignif.]					
	(3) Control Group [+ Financial incentive, Energy saving tips] Households received a financial reward depending on the amount of electricity saved + a utility guide for household energy conservation	(3) (+2.0) [insignif.] / (-5.3) [insignif.]					
	(4) Goal Setting [+ Financial incentive, Energy saving tips] Households received a combination of the interventions in (2) and (3)	(4) (-3.7) [insignif.] / (-11.0) [insignif.]					
	(5) Control Group Households were asked to fill in a short energy conservation survey	(5) (+7.5) [insignif.] / (+0.2) [insignif.]					
	(6) Control Group Households agreed to have their electricity meters read by the experimenters	(6) CG / (-7.3) [insignif.]					
van Houwelingen and van Raaij (1989)	**(1) Feedback, Goal Setting** [+ Energy saving tips] SmartMeter and IHDs were installed and households were asked to monthly jot down their preferred and actual consumption of gas. Externally imposed goal: 10% consumption reduction in comparison to preceding year. Additionally tips to save energy.	(1) n.a. / (-12,3)***	325	Gas	NL	RCT[10]	**Long run effects :** (one year after end of the intervention) (1) insign. / (-2,1)* (2) insign. / (-3,2)** (3) n.a. / (-1,5) (insign.) (4) n.a. / (+1,4) (insign.) (5) n.a. / (-2,2)* (6) n.a. / (-2,9)*
	(2) Feedback [+ Energy saving tips]	(2) n.a. / (-7,7)***					

[10] *The description of the study suggests an experimental design such as an RCT, even though the random assignment (to control and experimental groups) is not explicitly mentioned.*

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	Monthly feedback (not stated through which canal) and tips to save energy						**Costs:** n.a.
	(3) Feedback [+ Energy saving tips] Households were asked to document their monthly gas consumption on observation sheets, additionally tips to save energy	(3) n.a. / (-5,1)***					
	(4) Control Group [+ Energy saving tips] Provision of tips to save energy	(4) n.a. / (-4,3)**					
	(5) Control Group No information about participation in experiment	(5) n.a. / (-0,3) (insign.)					
	(6) Control Group Contacted households did not want to participate in the experiment	(6) CG / (-0,2) (insign.)					
McCalley and Midden (2002)	Laboratory study, in which the participants had to set up washing machines on a computer: the first six washing cycles for an evaluation of the „base consumption“, which the participants received feedback about. The following interventions were randomly assigned, afterwards another 20 washing cycles.		100	Electricity	NL	Laboratory Experiment	**Long run effects :** n.a. **Costs:** n.a.
	(1) Control Group No Feedback, no goal	(1) CG / no difference to (2)					
	(2) Feedback Feedback, no goal	(2) n.a. / (-9,6) (insign.)					
	(3) Feedback, Goal Setting, Commitment Feedback, self-imposed goal (Options: 0%, 5%, 10%, 15%,20%)	(3) (-12,3***) / (-21,9)***					
	(4) Feedback, Goal Setting Feedback, externally imposed goal (20%)	(4) (-9,9)** / (-19,5)**					
Abrahamse et al. (2007)	**(1) Feedback, Goal Setting** Externally set goal of energy conservation (5%), online feedback about personal consumption after two and five months	(1) + (2) significant difference	189	Electricity, Gas	NL	RCT	Effects refer to direct energy consumption, not to the as well measured indirect consumption, because the indirect consumption

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	(2) Feedback, Goal Setting [+ Framing (social norm)] Like (1) plus a mutual goal (all together saving 5%) and online feedback about the group´s consumption after two and five months	to control group*** / (-8,3)		(and gasoline)			strongly varied and was not seen as robust by the authors. For the analysis of the direct energy consumption both treatment groups were taken together, as there were no significant differences between them. **Long run effects :** n.a. **Costs:** n.a.
	(3) Control Group Twice filling out a questionnaire, no other intervention	(3) CG / (+0,4) (insign.)					
Harding and Hsiaw (2014)	Offer for customers to participate in program to save electricity. Range of goals to set for oneself between 0%, 0-15%, 15-50%, over 50%		12 451	Electricity	US	Matching	Households with optimistic goals (15-50%) save quite a lot shortly after start of the program. This effect wanes after two to three months, presumably because the consumers realized that they would not be able to reach their very optimistic goals. **Long run effects (** after 18 months**)** for (2): Significant effects with significance level of 95%; no specific statements about size **Costs:** n.a.
	(1) Feedback, Goal Setting, Commitment [+ Comparison to usage history] Self-set goal: 0%, daily access to website with monthly bills of consumption	(1) (-1,5) (not sign.) / n.a.					
	(2) Feedback, Goal Setting, Commitment [+ Comparison to usage history] Self-set goal : 0 - 15%, daily access to website with monthly bills of consumption	(2) (-11,0)** / n.a.					
	(3) Feedback, Goal Setting, Commitment [+ Comparison to usage history] Self-set goal : 15-50%, daily access to website with monthly bills of consumption	(3) (-1,0) (not sign.) / n.a.					
	(4) Feedback, Goal Setting, Commitment [+ Comparison to usage history] Self-set goal : über 50%, daily access to website with monthly bills of consumption	(4) 0 / n.a.					
	(5) Control Group No information about participation in experiment	(5) CG / n.a.					
Labeling							
	Laboratory experiment: Choice between four refrigerators		120		NL		

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
Verplanken and Weenig (1993)	**(1) Control Group** Information on consumption in kWh, no time pressure **(2) Labeling** [+ graphical enhancement] Annual energy consumption as graphical label (measured in local currency), no time pressure **(3) Control Group** Information on consumption in kWh, time pressure (5 minutes for decision) **(4) Labeling** [+ graphical enhancement] Annual energy consumption as graphical label, time pressure	(1) 27 (2) 50* (3) 33 (4) 23		Electricity (indirect)		Choice-Experiment with random assignment to experimental groups	Effect = share of group that prefers an efficient refrigerator to an inefficient one in % **Long run effects :** n.a. **Costs:** n.a.
Kurz et al. (2005)	**(1) Labeling** A series of labels was placed on different appliances in the household: refrigerators, air conditioners, showers, washing machines, clothes dryers, dishwashers, toilets and outdoor taps. The labels provided information about the water and energy-consumption levels of the labeled appliances. **(2) Control Group** Households were provided with the same information as in treatment (1) but in the form of information leaflets instead of labels **(3) Feedback, Social Comparison** [+ Graphical enhancement] Households received e-mails with graphical feedback on their levels of water and energy consumption and a comparison to other households of similar size who participated in the study	(1) n.a. / from insign. to (-23)** (2) n.a. / insignif. (3) n.a. / insignif.	166	Electricity and Water	AU	RCT	The study reports the effects for seven weeks separately, without documenting an average treatment effect. Therefore, we report the interval of the documented effects. **Long run effects:** n.a. **Costs:** n.a.
Brounen and Kok (2011)	**Labeling** Analysis of the effect of the EU label for energy efficiency on the sales price of houses with a „green“ label (A, B or C)	(+3,7)***	31 993	Electricity, water, gas (indirect)	NL	Observation study, controlled for self-selection	Effect = average mark-up in % on houses with „green“ label relative to comparable houses **Long run effects:** n.a.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
						with two-step Heckman-procedure	**Costs:** n.a.
Heinzle (2012)	<u>Experiment 1:</u> Participants are asked to evaluate the energy saving potential of different TVs. The provided information varies: **(1) Labeling** Consumption information in Watt and current price for electricity **(2) Labeling** Consumption information in Watt **(3) Labeling** Actual annual operating costs of the devices	(1) 18,6 / 66,3 / 15,1 (2) 19,8 / 64,0 / 16,3 (3) 92,5 / 3,8 / 3,8 *** (significant difference to the other treatment groups)	(1)-(3) 252	Electricity (indirect)	DE	Choice-Experiments with random assignment to experimental groups within a survey	Effects (1)-(3) = Proportion of participants who correctly estimate the energy saving potential in % / who overestimate / who underestimate
	<u>Experiment 2:</u> Choice between two TVs with differing information: **(4) Control Group** Consumption information in Watt (60 Watt vs. 225 Watt) **(5) Labeling** Absolute operating costs for the course of ten years (180€ vs. 660 €) **(6) Labeling** Annual operating costs (18€/year vs. 66€/year)	(4) 481,22 (5) 641,96** (6) 353,97**	(4)-(6) 208				Effects (4)-(6) = Median willingness to pay for a more efficient TV in Euro (actual saving potential: 480 Euro). **Long run effects:** n.a. **Costs:** n.a.
Houde (2014)	<u>Natural Experiment 1:</u> **(1) Labeling** The tightening of the criteria for the receipt of the Energy Star Label in 2008 in the US allowed to observe the willingness to pay for the same models of	(1) (+19)** / 1,5		Electricity (indirekt)	US	Two natural experiments	Effects (1)+(2) = Average willingness to pay for the Energy Star Label in $ / share of total price for refrigerator in %

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	refrigerators in the same store with and without the label (before and after the change of regulation) Natural Experiment 2: **(2) Labeling** In January 2010 it was published that some refrigerators received the Energy Star Label, although they did not actually fulfil the criteria (incorrect appliance of the test procedure). Because the following withdrawal of the label could not be anticipated by either the producers or the customers, the label´s value can be determined by the willingness to pay for these models of refrigerators before and after January 2010.	(2) (+89,6) (insign.) / 7,07	(2) 184 645				**Long run effects:** n.a. **Costs:** The opportunity costs of imperfect information amount to about $ 15 per refrigerator sold. Extrapolated on the whole market for refrigerators that makes a sum of $ 135 mil/year. According to the author that is twice as much as the annual costs for the Energy Star Label program.
Newell and Siikamäki (2014)	Survey (online) about six different hypothetical purchase decisions for warm water processors. There are three boilers to choose from. The boilers differ in price and each boiler is labelled with a different version of the Energy Star Label, which differ in the kind of information that is provided: **(1) Labeling** Only the simple consumption information is provided **(2) Labeling** Like (1) + relative consumption costs in comparison to different devices **(3) Labeling** Like (2) + Information about the CO2 emissions **(4) Labeling** Like (2) + specific information on energy consumption **(5) Labeling** [+ graphical enhancement] Wie (4) + awarded with an „Energy-Star-Label“ **(6) Labeling** [+ graphical enhancement]	(1) 0,7** (2) 0,68** (3) 0,93 (insign.) (4) 1,02 (insign.) (5) 1,36** (6) 1,34**	1 184	Electricity and gas (indirect)	US	Choice-Experiment with random assignment to experimental groups	Effects = relative willingness to pay for energy-efficient devices: a WTP of 1 stands for cost minimizing behavior, where a change in sales price and a change in the operating costs are equally weighted. A value lower than 1 shows an underestimation of savings through energy efficiency, while a value greater than 1 shows an overestimation. The significance is measured as the difference to 1. **Long run effects:** n.a. **Costs:** n.a.

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	Like (1) + Information about energy consumption in relation to other devices in overseeable nuances (A-G ranking: „EU-Style“)						
Ölander and Thøgersen (2014)	Choice between four TV devices with different labels; question which device the customer would buy **(1) Labeling** Labels with energy efficiency grades from A - G **(2) Labeling** Labels with energy efficiency grades from A+++ - D	(1) + (2) The scale from A – G more than doubled the probability to choose an energy-efficient device in comparison to the scale from A+++ - D	151	Electricity (indirect)	DK	Choice-Experiment with random assignment to experimental groups	**Long run effects:** n.a. **Costs:** n.a.
Allcott and Taubinsky (2015)	<u>Experiment 1:</u> Choice between an energy-saving bulb and three conventional bulbs with comparable power. **(1) Labeling** Information about consumption, cost saving with energy-saving bulbs, downsides of energy-saving bulbs (+ Information like in (2)) **(2) Control Group** Information about amount of energy-saving bulbs sold and sales development in the past. <u>Experiment 2:</u> Customers in a big electrical store were asked about their consumption behavior and with their individual information a comparison of the energy consumption of energy-saving bulbs and conventional bulbs was provided via Ipad:	(1) (+2,30)*** / n.a. (2) CG	(1) + (2) 1 533	Electricity (indirect)	US	<u>Experiment 1:</u> „Artificial field experiment“: Choice - Experiment with random assignment to experimental groups. One of 30 choices (randomly selected) leads to actual buying decision.	For experiment 1 several treatment groups were summarized for the analysis. Effects (1) = Willingness to pay in Dollar for an energy-saving bulb in comparison to a conventional bulb and in comparison to the control group (2)
	(3) Labeling [+ Financial incentive] Annual and total energy costs + discount coupon (10% on all bulbs)	(3) (-2,2) (insign.)	(3)-(6) 1 087			<u>Experiment 2:</u> RCT	Effects (3)-(6) = Probability of the purchase of an energy-saving bulb in comparison to conventional bulbs after the

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	(4) Labeling [+ Financial incentive] Annual and total energy costs + discount coupon (10% on all bulbs, 30% on energy-saving bulbs)	(4) (+11,0) (insign.)					information treatment and in comparison to the control group in percentage points. **Long run effects:** n.a. **Costs:** n.a.
	(5) Control Group [+ Financial incentive] No interview/information, discount coupon (10% on all bulbs, 30% on energy-saving bulbs)	(5) +(7,8)*					
	(6) Control Group [+ Financial incentive] No interview/information, discount coupon (10% on all bulbs)	(6) CG; Probability for purchase of an energy-saving bulb: 38%					
Waechter et al. (2015)	Experiment 1: On the basis of a scale from 0 (not efficient) to 100 (very efficient) the participants had to estimate the energy consumption of a TV. Four different versions of a label (randomly assigned) provided information on the grade of energy efficiency (A – high, B – low) and the electricity consumption (high, low).	Experiment 1:	Experiment 1: 166	Electricity (indirect)	Online-experiment, which was conducted in Switzerland	Experiment 1: Choice-Experiment with random assignment to experimental groups	**Dependent variables:** Experiment 1: Estimation of the energy efficiency of the TV devices
	(1) Labeling Information about the grade of energy efficiency of the TV devices	(1) The higher the grade of energy efficiency, the lower the estimates for the electricity consumption (significant***)					
	(2) Control Group Information about the electricity consumption of the TV devices	(2) No effect on estimates of electricity consumption					
	Experiment 2: On the basis of two devices with different labels, participants had to decide which device they would recommend to an		Experiment 2: 305			Experiment 2: no groups	Experiment 2: Share of participants who wrongly recommended the device with the

Study	Type of intervention [+ combination with additional interventions] and intervention design	Effect (in %) in comparison to: control group / baseline	n	Dependent Variable	Country	Method of causal analysis	Remarks
	energy conserving person. The device with the higher grade of energy efficiency thereby featured the higher actual energy consumption.						higher actual energy consumption in %
	(1) Labeling Device = TV	(1) 44.6					
	(2) Labeling Device = Freezer	(2) 72.8					
	Experiment 3: On the basis of two different labels participants had to evaluate the energy consumption of a freezer in comparison to a reference refrigerator, whereas the labels differed only in the grade of energy efficiency, but not in actual energy consumption.		Experi-ment 3: 166			Experiment 3: Choice-Experiment with random assignment to experimental groups	Experiment 3: Estimation of the energy consumption of the freezer compared to the reference refrigerator on a scale from 1 to 100
	(1) Labeling Label: „Grade of energy efficiency: A+++“	(1) 67.72**					**Long run effects:** n.a.
	(2) Control Group „ Grade of energy efficiency: A+“	(2) 77.07 (CG)					**Costs:** n.a.

Appendix B (Intended for online publication):

The keyword search in EconLit comprised the categories “Title”, “Abstract”, and “Subjects (SU)” for both journal articles and working papers. In ScienceDirect, we searched with keywords in the category “Abstract, Title, Keywords” and included articles from the disciplines “Economics, Econometrics, Finance”, “Psychology”, “Social Sciences”, “Environment”, and ”Energy”.

Table B1: „List of Keywords“

Intervention	Keywords
Social Comparison	"social norms" OR "social learning" OR "social modeling" OR "social influence" OR "peer comparison" OR "peer information" OR "comparative energy information" OR "feedback" *AND* "energy conservation" OR "energy consumption" OR "energy use" OR "energy usage" OR "energy demand*" OR "energy saving" OR "electricity conservation" OR "electricity consumption" OR “electricity use” OR "electricity usage" OR "electricity demand*" OR “electricity saving” OR “gas conservation” OR "gas consumption" OR "gas use" OR “gas usage” OR “gas demand*” OR “gas saving” OR "water conservation" OR “water consumption” OR "water use" OR “water usage” OR “water demand*” OR “water saving” OR "conservation behavior"
Commitment	"pre-commitment" OR "precommitment" OR "pledge" OR "behavioral contract" OR "commitment contract" OR "commitment devices" OR "commitment approach*" OR "personal commitment" OR "public commitment" OR "self-control" OR "self-regulation" *AND* "energy conservation" OR "energy consumption" OR "energy use" OR "energy usage" OR "energy demand*" OR "energy saving" OR "electricity conservation" OR "electricity consumption" OR “electricity use” OR "electricity usage" OR "electricity demand*" OR “electricity saving” OR “gas conservation” OR "gas consumption" OR "gas use" OR “gas usage” OR “gas demand*” OR “gas saving” OR "water conservation" OR “water consumption” OR "water use" OR “water usage” OR “water demand*” OR “water saving” OR "conservation behavior"
Goal-Setting	"goal setting" *AND* "energy conservation" OR "energy consumption" OR "energy use" OR "energy usage" OR "energy demand*" OR "energy saving" OR "electricity conservation" OR "electricity consumption" OR “electricity use” OR "electricity usage" OR "electricity demand*" OR “electricity saving” OR “gas conservation” OR "gas consumption" OR "gas use" OR “gas usage” OR “gas demand*” OR “gas saving” OR "water conservation" OR “water consumption” OR "water use" OR “water usage” OR “water demand*” OR “water saving” OR "conservation behavior"
Labeling	"energy labeling" OR "energy labelling" OR "information label*" OR "energy information" OR "energy label" OR "information acquisition" OR "information disclosure" OR "environmental certification" *AND* "energy conservation" OR "energy consumption" OR "energy use" OR "energy usage" OR "energy demand*" OR "energy saving" OR "electricity conservation" OR "electricity consumption" OR “electricity use” OR "electricity usage" OR "electricity demand*" OR “electricity saving” OR “gas conservation” OR "gas consumption" OR "gas use" OR “gas usage” OR “gas demand*” OR “gas saving” OR "water conservation" OR “water consumption” OR "water use" OR “water usage” OR “water demand*” OR “water saving” OR "conservation behavior"

Analysis refers to this standardized inclusion decision form in Citavi. If one of the criteria was coded with "no", the study was excluded from the systematic review.

Table B2: „Inclusion Decision Form"

Author (year)	Text
Title	Text
Name of coder	Text
Study includes applied research (not just theoretical models)	Options: yes / no / discuss
Study includes at least one of the chosen interventions	Options: Feedback / Social Comparison / Commitment / Goal-Setting / Labeling / discuss
Study refers to at least one of the outcome variables	Options: gas / water / electricity / discuss
Study targets private households or individuals in private households	Options: yes / no / discuss
Study was carried out in a developed country	Options: yes / no / discuss
Inclusion decision	Options: include / exclude / relevant meta-study / discuss

Table B3: „Coding Sheet“

Study	Authors (year)	Text
Type of intervention	*e.g.* *(1) 1* *(2) 1+2* *(3) 1+2+4* *(4) 0*	Open code 0 = Control group 1 = Feedback 2 = Social comparison 3 = Commitment 4 = Goal-setting 5 = Labeling 1+2= Feedb.+ Social Comparison 3+4= Commitment + Goal-Setting
Intervention design	*e.g.* *(1) Onetime letter, external goal (5%)* *(2) Onetime letter, self-set goal* *(3) Onetime letter, external goal, comparison with another treatment group*	Text
Combination with additional interventions	*e.g.* *(1) None* *(2) Energy saving tips* (3) *None*	Text
Effect (in %) in comparison to: control group / baseline Significance level: ***: p < 0,01 **: p < 0,05 *: p < 0.10 (insign.): not significant	*e.g.* *(1) (-2,2)** / (-5,4)*** *(2) (-2,7)* / (-10,0)** *(3) (-0.5) (insignif.) / (-1,9)** *(4) KG / (-1,1) (insignif.)*	Number
N	*e.g.* *34000*	Number
Dependent variable	*e.g.* *2*	Open Code 1 = Electricity 2 = Water 3 = Gas For Labeling: 1A = Electricity (indirectly) 2A = Water (indirectly) 3A = Gas (indirectly)
Country	*e.g.* *US*	Country code
Method of causal analysis	*e.g.* *1*	Open code 1 = RCT 2 = Matched Comparison 3 = RDD 4 = Diff-in-Diff 5 = FE 6 = Other
Remarks	*e.g.* *(1) Limitations* *(2) Cost-benefit-analysis* *(3) Long run effect + follow-up period after intervention*	Text